

Recommended text for the addition of microQSFP, QSFP-DD and OSFP MDIs to 802.3cd:

(Tom Palkert: 2017/03/07)

section 136.11

Since 50GBASE-CR has five specified MDI connectors, single-lane (SFP28, specified in 110.11.1), multi-lane (QSFP28, specified in 92.12, microQSFP, specified in 136.12.1, QSFP-DD specified in 136.12.2 or OSFP specified in 136.12.3), there are multiple possible combinations of the connectors at each end. The possible 50GBASE-CR cable assembly types are described in Annex 136C. 100GBASE-CR2 uses two lanes of the multi-lane MDI connectors.

200GBASE-CR4 uses four lanes of the multilane MDI connectors.

Note that MDIs with multiple lanes but can also be used as a single-lane MDI due to their density.

#### 136.11.7.2.2 QSFP28 (or microQSFP) to SFP28

The QSFP28 (or microQSFP) to SFP28 channel structure includes the signal path, three alien far-end and one near-end crosstalk path. These five paths are used in calculation of COM. Crosstalk from transmitters on other SFP28 connectors is assumed to be insignificant.

The signal path is calculated using Equation (136-8).

The near-end crosstalk path is calculated using Equation (136-9), with  $k$  equal to 1.

The three alien far-end crosstalk paths are calculated using Equation (136-10), with  $k$  values from 1 to 3.

#### 136.11.7.2.3 SFP28 to QSFP28 (or microQSFP)

The SFP28 to QSFP28 (or microQSFP) channel structure includes the signal path, three alien far-end and four near-end crosstalk paths. These eight paths are used in calculation of COM.

The signal path is calculated using Equation (136-8).

The near-end crosstalk paths are calculated using Equation (136-9), with k values from 1 to 4. The three alien far-end crosstalk paths are calculated using Equation (136-10), with k values from 1 to 3.

#### 136.11.7.2.4 QSFP28 (or microQSFP) to QSFP28 (or microQSFP)

The QSFP28 (or microQSFP) to QSFP28 (or microQSFP) channel structure includes the same paths defined for the SFP28 (or microQSFP) to QSFP28 (or microQSFP) channel, and COM is calculated in the same way, as defined in 136.11.7.2.3.

#### 136.11.7.2.5 QSFP-DD /OSFP to SFP

The QSFP-DD/ OSFP to SFP28 channel structure includes the signal path, seven alien far-end and one near-end crosstalk path. These eight paths are used in calculation of COM. Crosstalk from transmitters on other SFP28 connectors is assumed to be insignificant.

The signal path is calculated using Equation (136-8).

The near-end crosstalk path is calculated using Equation (136-9), with k equal to 1.

The seven alien far-end crosstalk paths are calculated using Equation (136-10), with k values from 1 to 7.

#### 136.11.7.2.6 SFP28 to QSFP-DD /OSFP

The SFP28 to QSFP-DD/OSFP channel structure includes the signal path, seven alien far-end and eight near-end crosstalk paths. These sixteen paths are used in calculation of COM.

The signal path is calculated using Equation (136-8).

The near-end crosstalk paths are calculated using Equation (136-9), with k values from 1 to 8.

The three alien far-end crosstalk paths are calculated using Equation (136-10), with k values from 1 to 7.

#### 136.11.7.2.7 QSFP-DD/OSFP) to Q SFP28 /microQSFP

The QSFP-DD/OSFP to QSFP28/microQSFP channel structure includes the signal path, seven alien far-end and three near-end crosstalk path. These ten paths are used in calculation of COM. Crosstalk from transmitters on other QSFP28 /microQSFP connectors is assumed to be insignificant.

The signal path is calculated using Equation (136-8).

The near-end crosstalk path is calculated using Equation (136-9), with k equal to 3.

The seven alien far-end crosstalk paths are calculated using Equation (136-10), with k values from 1 to 7.

#### 136.11.7.2.8 QSFP28/microQSFP to QSFP-DD/OSFP

The QSFP28/microQSFP to QSFP-DD/OSFP channel structure includes the signal path, seven alien far-end and eight near-end crosstalk paths. These sixteen paths are used in calculation of COM.

The signal path is calculated using Equation (136-8).

The near-end crosstalk paths are calculated using Equation (136-9), with k values from 1 to 8.

The three alien far-end crosstalk paths are calculated using Equation (136-10), with k values from 1 to 7.

#### 136.11.7.2.9 QSFP-DD/OSFP to QSFP-DD/OSFP

The QSFP-DD/OSFP to QSFP-DD/OSFP channel structure includes the signal path, seven alien far-end and seven near-end crosstalk path. These fourteen paths are used in calculation of COM..

The signal path is calculated using Equation (136-8).

The near-end crosstalk path is calculated using Equation (136-9), with k equal to 7.

The seven alien far-end crosstalk paths are calculated using Equation (136-10), with k values from 1 to 7.

#### 136.12 MDI specifications

This subclause defines the 50GBASE-CR, the 100GBASE-CR2, and the 200GBASE-CR4 Media Dependent Interface (MDIs). The MDI couples the PMD (specified in 136.8 and 136.9) to the cable assembly (specified in 136.11).

For 50GBASE-CR, the mechanical interface between the PMD and the cable assembly may be either of three options: a mated pair of connectors meeting the requirements of

- 1) 110.11.1 (single-lane MDI)
- 2) 92.12.1.1 (Four-lane MDI)
- 3) 136.12.1 (four-lane MDI)
- 4) 136.12.2 (eight-lane MDI)
- 5) 136.12.3 (eight-lane MDI)

The plug connector is used on the cable assembly and the receptacle is used on the PMD. For the four-lane MDI, each of the paired transmit and receive lanes (SL0, DL0), (SL1, DL1), (SL2, DL2) or (SL3, DL3) may be used for the transmit and receive connections (SL and DL). For the eight-lane MDI, each of the paired transmit and receive lanes (SL0, DL0), (SL1, DL1), (SL2, DL2), (SL3, DL3), (SL4, DL4), (SL5, DL5), (SL6, DL6) or (SL7, DL7) may be used for the transmit and receive connections. In cases where the connector meeting the requirements of 136.12.1 (multi-lane MDI) is used for a single-lane 50GBASE-CR cable, the paired transmit and receive lanes for one PHY shall be (SL0, DL0).

For 100GBASE-CR2 or 200GBASE-CR4, the mechanical interface between the PMD and the cable assembly is a mated pair of connectors meeting the requirements of 92.12.1.1 (multi-lane MDI) or 136.12.1 (multi-lane). The plug connector is used on the cable assembly and the receptacle is used on the PMD. For 100GBASE-CR2 multilane MDI, the paired transmit and receive lanes for one PHY shall be (SL0, DL0) and (SL1, DL1), and if a second PHY uses the same MDI connector it uses (SL2, DL2) and (SL3, DL3).

For 50GBASE-CR, 100GBASE-CR2 and 200GBASE-CR4 plug connectors, the receive lanes are AC-coupled; the AC-coupling shall be within the plug connectors. It should be noted that there may be various methods for AC-coupling in actual implementations. The low-frequency 3 dB cutoff of the AC-coupling shall be less than 50 kHz. It is recommended that the value of the coupling capacitors be 100 nF. The capacitor limits the inrush charge and baseline wander.

#### 136.12.1 Style-1 50GBASE-CR, 100GBASE-CR2, 200GBASE-CR4 MDI connector

The Style-1 MDI connector can support all three cable types described by this clause. The connector for each end of the cable assembly shall be the microQSFP connector plug with the mechanical mating interface defined in the microQSFP MSA Specification and illustrated in Figure 136-11. The MDI connector shall be the microQSFP receptacle with the mechanical mating interface defined by the microQSFP MSA Specification and illustrated in Figure 136-12. These connectors have contact assignments that are listed in Table 136-16, and electrical performance consistent with the signal quality and electrical requirements of 136.9 and 136.10. This MDI can be applied in 1-lane, 2-lane and 4-lane applications due to its port density.

The Style-1 MDI connector of the 50GBASE-CR, the 100GBASE-CR2, and the 200GBASE-CR4 PMD comprises 38 signal connections. The Style-1 50GBASE-CR, 100GBASE-CR2, and 200GBASE-CR4 MDI connector contact assignments shall be as defined in Table 136-

16. Note that the source lanes (SL), signals SLi<p>, and SLi<n> are the positive and negative sides of the transmitters differential signal pairs and the destination lanes (DL) signals, DLi<p>, and DLi<n> are the positive and negative sides of the receivers differential signal pairs for lane i (i = 0, 1, 2, 3).

See supplemental file sent with comment file for 2 Figures and one Table that accompany this new material.

#### 136.12.2 Style-2 and style-3 50GBASE-CR, 100GBASE-CR2, 200GBASE-CR4 MDI connector

The Style-2 and style 3 MDI connectors can support the eight lane cable types described by this clause. The connector for each end of the cable assembly shall be the style 2 QSFP-DD connector plug with the mechanical mating interface defined in the QSFP-DD MSA Specification and illustrated in Figure 136-13 or the style 3 OQSFP connector plug with the mechanical mating interface defined in the OQSFP MSA Specification and illustrated in Figure 136-15. The MDI connector shall be the QSFP-DD receptacle with the mechanical mating interface defined by the QSFP-DD MSA Specification and illustrated in Figure 136-14 or the OQSFP receptacle with the mechanical mating interface defined by the OQSFP MSA Specification and illustrated in Figure 136-16. These connectors have contact assignments that are listed in Table 136-17 and electrical performance consistent with the signal quality and electrical requirements of 136.9 and 136.10. These MDIs can be applied in 1-lane, 2-lane, 4-lane and 8-lane applications due to their port density.

The Style-1 MDI connector of the 50GBASE-CR, the 100GBASE-CR2, and the 200GBASECR4 PMD comprises 38 signal connections. The Style-1 50GBASE-CR, 100GBASE-CR2, and 200GBASE-CR4 MDI connector contact assignments shall be as defined in Table 136-

16. Note that the source lanes (SL), signals SLi<p>, and SLi<n> are the positive and negative sides of the transmitters differential signal pairs and the destination lanes (DL)

signals, DLi<p>, and DLi<n> are the positive and negative sides of the receivers differential signal pairs for lane i (i = 0, 1, 2, 3).

The Style-2 and style-3 MDI connectors of the 50GBASE-CR, the 100GBASE-CR2, and the 200GBASECR4 PMD comprises 76 signal connections for style 2 and xx signal connections for style 3. The Style-2 and style 3 50GBASE-CR, 100GBASE-CR2, and 200GBASE-CR4 MDI connector contact assignments shall be as defined in Table 136-

17. Note that the source lanes (SL), signals SLi<p>, and SLi<n> are the positive and negative sides of the transmitters differential signal pairs and the destination lanes (DL) signals, DLi<p>, and DLi<n> are the positive and negative sides of the receivers differential signal pairs for lane i (i = 0, 1, 2, 3, 4, 5, 6, 7).

See supplemental file sent with comment file for 2 Figures and one Table that accompany this new material.

Clause 136C.1 page 371 line 16:

Hosts have five specified MDI connectors, single-lane (SFP28, specified in 110.11.1), multi-lane (QSFP28, specified in 92.12, microQSFP, specified in 136.12.1, QSFP-DD specified in 136.12.2 and OSFP specified in 136.12.3.

Clause 136C.2.3 Insert new Paragraph:

QSFP-DD and OSFP host form factors

A QSFP-DD or OSFP MDI has eight available lanes and can be used in either single-lane applications or multi-lane applications.

A host may use the QSFP-DD receptacle specified in 136.12.2 as the MDI for:

- 1) one, two or four 100GBASE-CR2 PHYs or
- 2) one or two 200GBASE-CR4 PHYs.

This is referred to as a QSFP-DD or OSFP host form factor.

A QSFP-DD or OSFP form factor host can also form up to eight 50 Gb/s links to:

- 1) another QSFP-DD or OSFP form factor host, using a QSFP-DD or OSFP to QSFP-DD or OSFP form factor cable assembly (see 136C.3.x), or to a QSFP28/microQSFP form factor host using a QSFP-DD/OSFP to QSFP28/microQSFP form factor cable assembly (see 136C.3.x) or to four separate QSFP28/microQSFP form factor hosts using a QSFP-DD/OSFP to 4xQSFP28/microQSFP form factor cable assembly (see 136C.3.x) or to eight separate SFP28 form factor hosts using a QSFP-DD/OSFP to 8xSFP28 form factor cable assembly (see 136C.3.x).

A QSFP-DD/ OSFP MDI has eight available lanes and can be used in either single-lane applications or multi-lane applications.

A host may use the QSFP-DD/OSFP receptacle specified in 136.12.3 as the MDI for the following:

- 1) one, two or four 100GBASE-CR2 PHYs
- 2) one or two 200GBASE-CR4 PHYs

This is referred to as a QSFP-DD (Style A) or OSFP (Style B) host form factor.

A QSFP-DD or OSFP form factor host can also form up to eight 50 Gb/s links to either another

QSFP-DD or OSFP form factor host, using a QSFP-DD or OSFP form factor cable

assembly (see 136C.3.x), or to a QSFP28/microQSFP form factor host using a QSFP-DD or OSFP to QSFP28/microQSFP form factor cable assembly (see 136C.3.x) or to four separate QSFP28/microQSFP form factor hosts using a QSFP-DD/OSFP to 4xQSFP28/microQSFP form factor cable assembly (see 136C.3.x) or to eight separate SFP28 form factor hosts using a QSFP-DD/OSSFP to 8xSFP28 form factor cable assembly (see 136C.3.x).

Add new Paragraph

136C.3.x QSFP-DD to OQSFP cable assembly form factor

The QSFP-DD to OQSFP cable assembly has one QSFP-DD plug, specified in 136.12.2

and one OQSFP plug, specified in 136.12.3. It may be used to connect one QSFP-DD

form factor host to one OQSFP form factor host (see 136C.2.2 and 136C.2.3) with up

to eight 50 Gb/s links. The cable assembly is illustrated in Figure 136C-x. The electrical

characteristics of a cable assembly for this form factor are specified in 136.11, using the

definitions in 136.11.7.2.4.

See supplemental file for image to go with this paragraph

Add new paragraph:

136C.3.x QSFP-DD/OSFP to 2×QSFP28/microQSFP cable assembly form factor

The QSFP-DD/OSFP to 2×QSFP28/microQSFP cable assembly has a QSFP-DD or OSFP plug as specified in

136.12.2/3 on one end, and two QSFP28/microQSFP plugs as specified in 110.11.1 on the other end. It

may be used to connect a QSFP-DD/OSFP form factor host (see 136C.2.3) to up to two QSFP28/microQSFP form factor hosts (see 136C.2.1) with four 50 Gb/s link to each QSFP28/microQSFP hosts. The cable assembly is illustrated in Figure 136C-x. The electrical characteristics of a cable assembly for this form factor are specified in 136.11, using the definitions in 136.11.7.2.2 and

136.11.7.2.3.

136C.3.x QSFP-DD/OSFP to 8×SFP28 cable assembly form factor

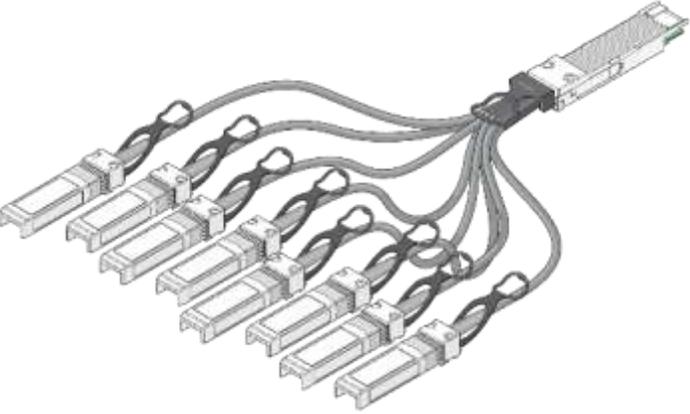
The QSFP-DD/OSFP to 8×SFP28 cable assembly has a QSFP-DD or OSFP plug as specified in

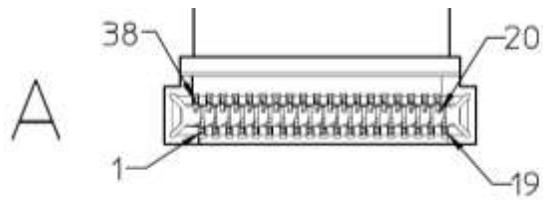
136.12.2/3 on one end, and eight SFP28 plugs as specified in 110.11.1 on the other end. It

may be used to connect a QSFP-DD/OSFP form factor host (see 136C.2.3) to up to eight SFP28 form factor hosts (see 136C.2.1) with one 50 Gb/s link to each SFP28 host. The cable assembly is illustrated in Figure 136C-x. The electrical characteristics of a cable assembly for this form factor are specified in 136.11, using the definitions in 136.11.7.2.2 and

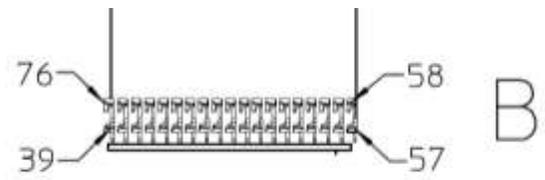
136.11.7.2.3.

See images below:



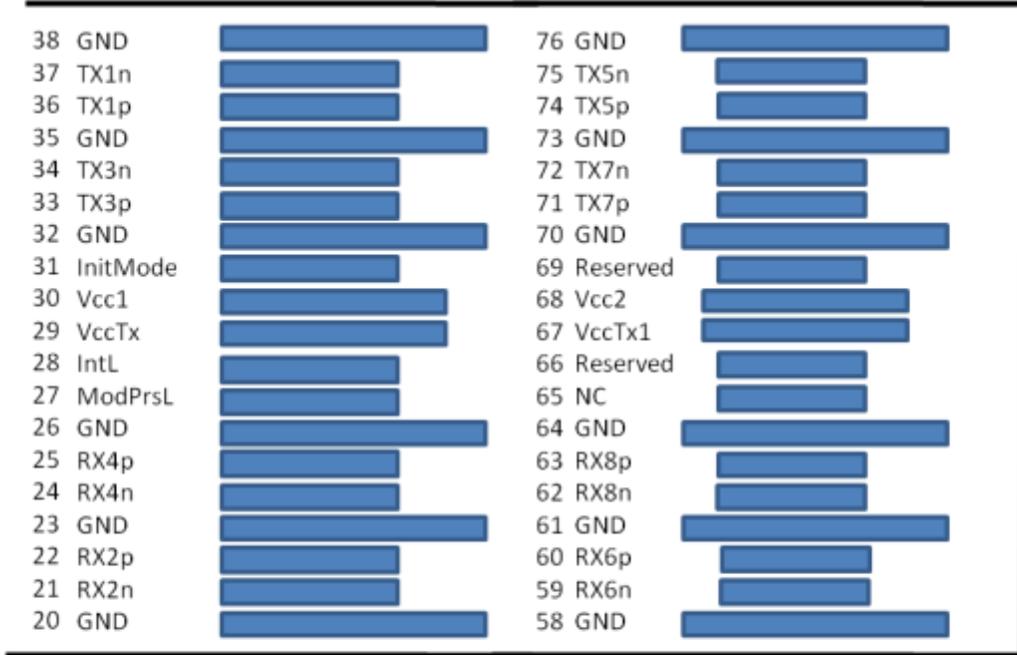


FORWARD CONTACTS



REAR CONTACTS

(Module Side)

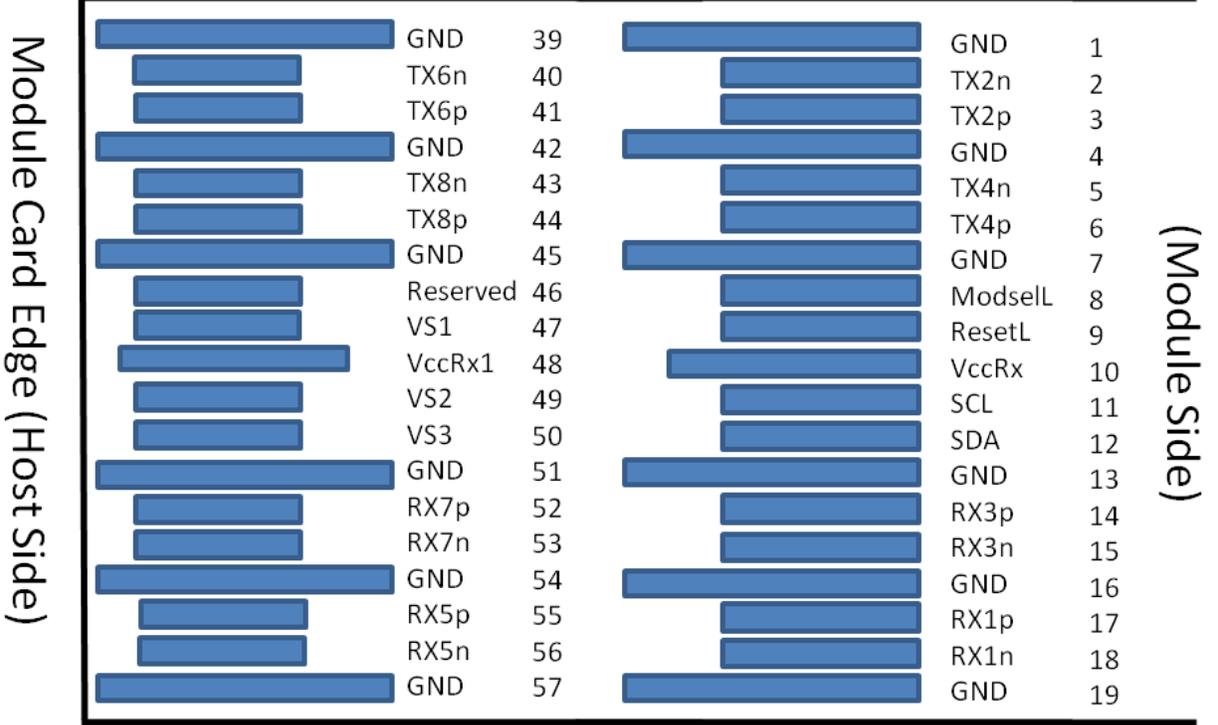


Module Card Edge (Host Side)

Top side viewed from top

↑  
Legacy QSFP28  
Pads

↑  
Additional  
QSFP-DD Pads



Bottom side viewed from bottom

↑  
Additional  
QSFP-DD Pads

↑  
Legacy QSFP28  
Pads