



# **MCP1600-E0xxEyy 100Gb/s QSFP28 DAC Cable Product Specifications**

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# Introduction

NVIDIA® MCP1600-E0xxxEyy DAC (Direct Attach Copper) cables are high speed, cost-effective alternatives to fiber optics in 100Gb/s InfiniBand EDR applications.

The QSFP28 passive copper cable<sup>[1]</sup> contains four high-speed copper pairs, each operating at data rates of up to 25Gb/s. Each QSFP28 port comprises an EEPROM providing product information, which can be read by the host system.

NVIDIA unique-quality cable solutions provide power-efficient connectivity for short distance interconnects. It enables higher port bandwidth, density and configurability at a low cost and reduced power requirement in the data centers.

Rigorous cable production testing ensures best out-of-the-box installation experience, performance and durability.

## Key Features

- Up to 100 Gb/s data rate
- SFF-8665 compliant QSFP28
- Operating case temperature 0-70°C
- Single 3.3V supply voltage
- Hot pluggable
- RoHS compliant
- LSZH (Low Smoke Zero Halogen) jacket
- LF (Lead Free) HF (Halogen Free) PCB
- SFF-8636 compliant I2C management interface



 Images are for illustration purposes only. Product labels, colors, and lengths may vary.

 [1] Raw cables are provided from different sources to ensure supply chain robustness.

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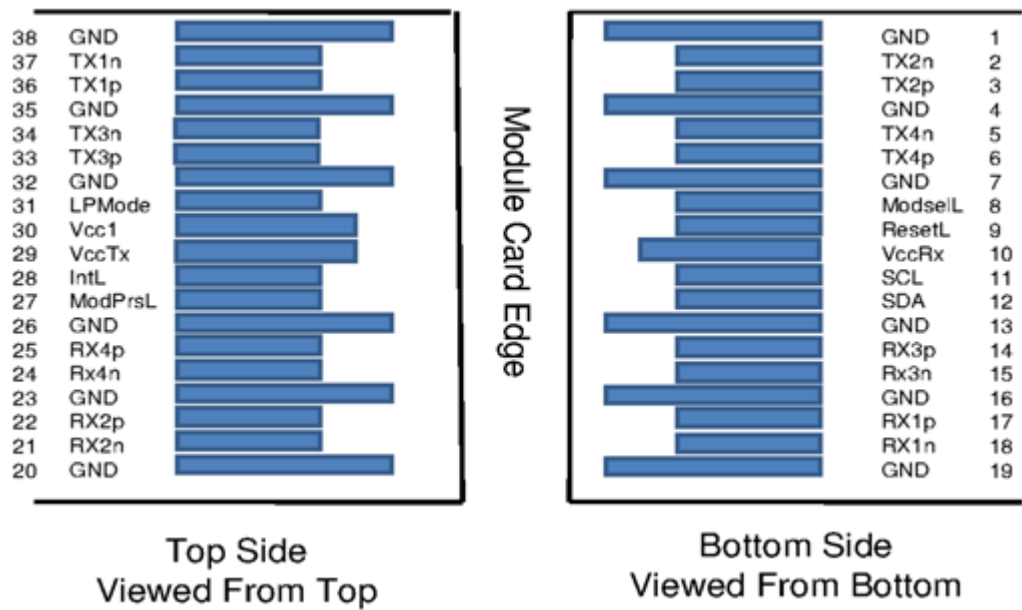
## Pin Description

The DAC (Direct Attach Copper) pin assignment is SFF-8679 compliant.

### QSFP28 Pin Description

| Pin | Symbol  | Description                         | Pin | Symbol  | Description                         |
|-----|---------|-------------------------------------|-----|---------|-------------------------------------|
| 1   | GND     | Ground                              | 20  | GND     | Ground                              |
| 2   | Tx2n    | Transmitter Inverted Data Input     | 21  | Rx2n    | Receiver Inverted Data Output       |
| 3   | Tx2p    | Transmitter Non-Inverted Data Input | 22  | Rx2p    | Receiver Non-Inverted Data Output   |
| 4   | GND     | Ground                              | 23  | GND     | Grounds                             |
| 5   | Tx4n    | Transmitter Inverted Data Input     | 24  | Rx4n    | Receiver Inverted Data Output       |
| 6   | Tx4p    | Transmitter Non-Inverted Data Input | 25  | Rx4p    | Receiver Non-Inverted Data Output   |
| 7   | GND     | Ground                              | 26  | GND     | Ground                              |
| 8   | ModSelL | Module Select                       | 27  | ModPrsL | Module Present                      |
| 9   | ResetL  | Module Reset                        | 28  | IntL    | Interrupt                           |
| 10  | Vcc Rx  | +3.3V Power Supply Receiver         | 29  | Vcc Tx  | +3.3V Power Supply Transmitter      |
| 11  | SCL     | 2-wire Serial Interface Clock       | 30  | Vcc1    | +3.3V Power Supply                  |
| 12  | SDA     | 2-wire Serial Interface Data        | 31  | LPMode  | Low Power Mode                      |
| 13  | GND     | GND                                 | 32  | GND     | Ground                              |
| 14  | Rx3p    | Receiver Non-Inverted Data Output   | 33  | Tx3p    | Transmitter Non-Inverted Data Input |
| 15  | Rx3n    | Receiver Inverted Data Output       | 34  | Tx3n    | Transmitter Inverted Data Input     |
| 16  | GND     | Ground                              | 35  | GND     | Ground                              |
| 17  | Rx1p    | Receiver Non-Inverted Data Output   | 36  | Tx1p    | Transmitter Non-Inverted Data Input |
| 18  | Rx1n    | Receiver Inverted Data Output       | 37  | Tx1n    | Transmitter Inverted Data Input     |
| 19  | GND     | Ground                              | 38  | GND     | Ground                              |

QSFP28 Module Pad Layout



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# Specifications

## Absolute Maximum Specifications

Absolute maximum ratings are those beyond which the device may be damaged.

Between the operational specifications and absolute maximum ratings, prolonged operation is not intended and permanent device degradation may occur.

| Parameter             | Min  | Max | Units |
|-----------------------|------|-----|-------|
| Supply voltage        | -0.3 | 3.6 | V     |
| Data input voltage    | -0.3 | 3.6 | V     |
| Control input voltage | -0.3 | 3.6 | V     |

## Environmental Specifications

This table shows the environmental specifications for the product.

| Parameter           | Min | Max | Units |
|---------------------|-----|-----|-------|
| Storage temperature | -40 | 85  | °C    |

## Operational Specifications

This section shows the range of values for normal operation.

| Parameter                   | Min   | Typ | Max   | Units |
|-----------------------------|-------|-----|-------|-------|
| Supply voltage ( $V_{CC}$ ) | 3.135 | 3.3 | 3.465 | V     |
| Power consumption           | ---   | --- | 0.1   | W     |
| Operating case temperature  | 0     |     | 70    | °C    |
| Operating relative humidity | 5     |     | 85    | %     |

## Electrical Specifications

| Parameter                | Min | Typ | Max | Units    | Note        |
|--------------------------|-----|-----|-----|----------|-------------|
| Characteristic Impedance | 90  | 100 | 110 | $\Omega$ |             |
| Propagation Delay        | --- | --- | 4.5 | ns/m     | Informative |

## EEPROM QSFP28 Memory Map I2C Address A0h

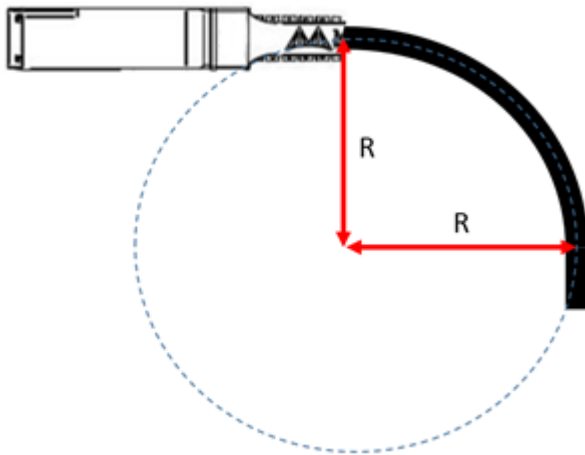
| Page 00h/<br>Dec. Byte Address | Register Name           | Description                                                                                                                                                                                                                   |
|--------------------------------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0                              | Identifier              | 0Dh: QSFP28 side of the cable.                                                                                                                                                                                                |
| 1                              | Status                  | 06h: Support for SFF-8436 Rev. 2.0                                                                                                                                                                                            |
| 128                            | Identifier              | 0Dh: QSFP28                                                                                                                                                                                                                   |
| 130                            | Connector               | 23h: Direct attach assemblies with no separable interfaces                                                                                                                                                                    |
| 146                            | Length                  | Length in units of 1 m of direct attach copper cable                                                                                                                                                                          |
| 147                            | Device technology       | A0h: Un-equalized copper cable (passive)                                                                                                                                                                                      |
| 148-163                        | Vendor name             | NVIDIA: ASCII                                                                                                                                                                                                                 |
| 165-167                        | QSFP vendor IEEE number | 00-02-C9: NVIDIA OUI.                                                                                                                                                                                                         |
| 168-183                        | Part number             | MCP1600-XXXXXXX: Part number per backshell label (ASCII)                                                                                                                                                                      |
| 184-185                        | Product revision        | ZZ: Revision per backshell label (ASCII)                                                                                                                                                                                      |
| 186                            | Attenuation 2.5GHz      | Typical attenuation in 1dB.                                                                                                                                                                                                   |
| 187                            | Attenuation 5GHz        |                                                                                                                                                                                                                               |
| 188                            | Attenuation 7GHz        |                                                                                                                                                                                                                               |
| 189                            | Attenuation 12.9GHz     |                                                                                                                                                                                                                               |
| 190                            | Max case temperature    | 46h: Support for 70°C                                                                                                                                                                                                         |
| 192                            | Link codes              | 0Bh                                                                                                                                                                                                                           |
| 196-211                        | Serial number           | MTYYWWXXSSSSS: Serial number per backshell label (ASCII). Refer to <a href="#">Backshell Label Legend</a> .                                                                                                                   |
| 212-217                        | Date code               | YYMMDD: Year YY, month MM, day DD.                                                                                                                                                                                            |
| 236                            | Length 0.1m             | Total cable length is the sum of byte 146 for number of meters and byte 236 for 0.1m.<br>Values:<br>00h: 0m<br>...<br>09h: 0.9m<br>Examples:<br>2.5m: Byte 146 = 02h, Byte 236 = 05h<br>2.25m: Byte 146 = 02h, Byte 236 = 03h |
| 237                            | AWG                     | DAC cable AWG information.<br>18h: AWG=24<br>19h: AWG=25<br>1Ah: AWG=26<br>1Ch: AWG=28<br>1Eh: AWG=30<br>20h: AWG=32                                                                                                          |

## Mechanical Specifications

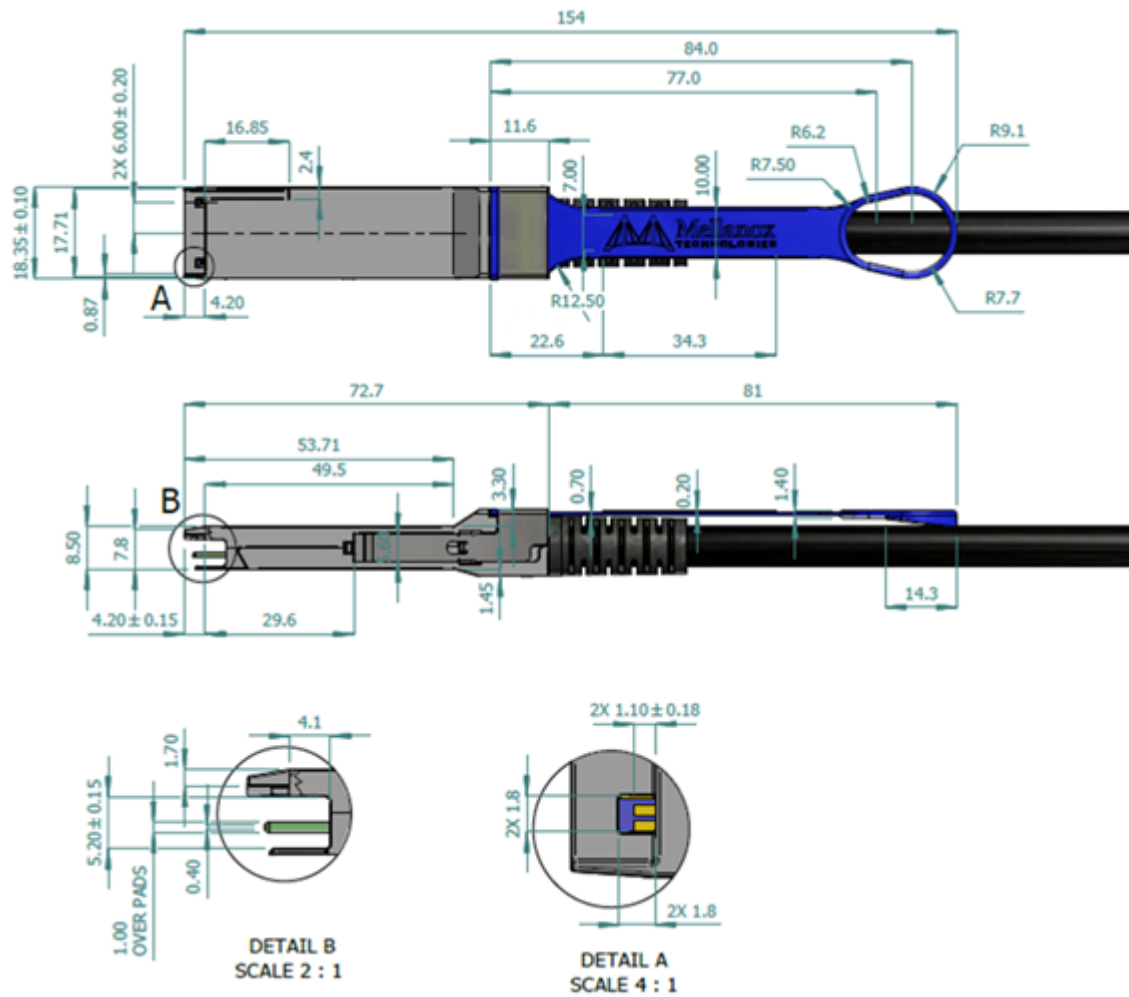
| <u>OPN</u>      | AWG | Single Cable Diameter | Minimum Bend Radius                                 | Length Tolerance | Cable Color |
|-----------------|-----|-----------------------|-----------------------------------------------------|------------------|-------------|
| MCP1600-E00AE30 | 30  | 7.1 ±0.35             | Single bend: 35.5mm<br>Assembly/repeated bend: 71mm | ±25mm            | Black       |
| MCP1600-E001E30 |     |                       |                                                     |                  |             |
| MCP1600-E01AE30 |     |                       |                                                     |                  |             |
| MCP1600-E002E30 |     |                       |                                                     |                  |             |
| MCP1600-E02AE26 | 26  | 9.4 ±0.4mm            | Single bend: 47mm<br>Assembly/repeated bend: 94mm   | ±50mm            |             |
| MCP1600-E003E26 |     |                       |                                                     |                  |             |
| MCP1600-E004E26 |     |                       |                                                     |                  |             |
| MCP1600-E005E26 |     |                       |                                                     |                  |             |

The minimum assembly bending radius (close to the connector) is 10x the cable's outer diameter. The repeated bend (far from the connector) is also 10x the cable's outer diameter. The single bend (far from the connector) is 5x the cable's outer diameter.

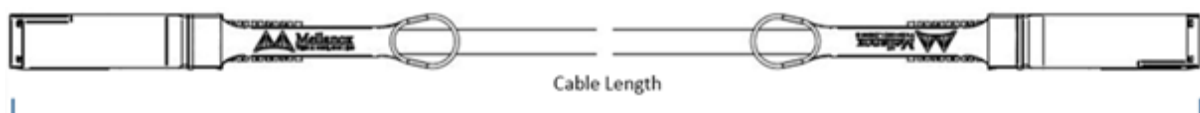
### Assembly Bending Radius



### Mechanical Dimensions

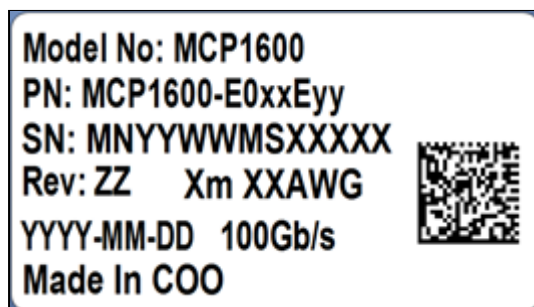


### Cable Length Definition



## Label Descriptions

The following label is applied on the cable's backshell:



(sample illustration)

### Backshell Label Legend

| Symbol                                                                            | Meaning               | Notes                                                        |
|-----------------------------------------------------------------------------------|-----------------------|--------------------------------------------------------------|
| xx                                                                                | Length                | Meter                                                        |
| yy                                                                                | Cable gauge           | American wire gauge                                          |
| MN                                                                                | Manufacturer name     | 2 characters MT                                              |
| YY                                                                                | Year of manufacturing | 2 digits                                                     |
| WW                                                                                | Week of manufacturing | 2 digit                                                      |
| MS                                                                                | Manufacturer site     | 2 characters                                                 |
| XXXXX                                                                             | Serial number         | 5 digits for serial number. Reset at start of week to 00001. |
| ZZ                                                                                | Revision              | 2 alpha-numeric characters                                   |
| Xm                                                                                | Cable length          | Meter                                                        |
| XXAWG                                                                             | Cable gauge           | American wire gauge                                          |
| YYYY-MM-DD                                                                        | Year-month-day        | Year 4 digits, month 2 digits, day 2 digits                  |
| COO                                                                               | Country of origin     | E.g. China or Malaysia                                       |
|  | Quick response code   | Serial number                                                |

The following labels are applied on the cable's jacket:



Note: The serial number and barcode are for NVIDIA internal use only.

 Images are for illustration purposes only. Product labels, colors, and lengths may vary.

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## Ordering Information

| Ordering Part Number | Description                                                             |
|----------------------|-------------------------------------------------------------------------|
| MCP1600-E00AE30      | Passive Copper cable, IB EDR, up to 100Gb/s, QSFP28, 0.5m, Black, 30AWG |
| MCP1600-E001E30      | Passive Copper cable, IB EDR, up to 100Gb/s, QSFP28, 1m, Black, 30AWG   |
| MCP1600-E01AE30      | Passive Copper cable, IB EDR, up to 100Gb/s, QSFP28, 1.5m, Black, 30AWG |
| MCP1600-E002E30      | Passive Copper cable, IB EDR, up to 100Gb/s, QSFP28, 2m, Black, 30AWG   |
| MCP1600-E02AE26      | Passive Copper cable, IB EDR, up to 100Gb/s, QSFP28, 2.5m, Black, 26AWG |
| MCP1600-E003E26      | Passive Copper cable, IB EDR, up to 100Gb/s, QSFP28, 3m, Black, 26AWG   |
| MCP1600-E004E26      | Passive Copper cable, IB EDR, up to 100Gb/s, QSFP28, 4m, Black, 26AWG   |
| MCP1600-E005E26      | Passive Copper cable, IB EDR, up to 100Gb/s, QSFP28, 5m, Black, 26AWG   |

Please see [cable length definition](#).

## Document Revision History

| Revision | Date          | Description                                                                                                                                                              |
|----------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2.7      | Dec. 2, 2021  | Reformatted and rebranded; migrated to on-line file. Removed BER bullet.                                                                                                 |
| 2.6      | Mar. 2021     | Updated the Mechanical Drawings                                                                                                                                          |
| 2.5      | Jul. 17, 2018 | Datasheet renamed to MCP1600-E0xxEyy_100Gbps_QSFP28_DAC_Datasheet. Label Description - Updated.                                                                          |
| 2.4      | Jun. 6, 2018  | Key Features - Enables BER...<br>Ordering Information - Removed note about availability.                                                                                 |
| 2.3      | Mar. 26, 2018 | Table: Cable Mechanical Specifications - Updated values.<br>Table: QSFP28 Memory Map I2C Address A0h - Description of byte 186 updated.                                  |
| 2.2      | Mar. 12, 2018 | Changed file name to MCP1600-E00XE26_100Gbps_QSFP28_DAC_Datasheet<br>Table: Ordering Part Number and Description - Added note about availability.                        |
| 2.1      | Feb. 19, 2018 | Figure: , page 1 - New photo.<br>Table: QSFP28 Memory Map I2C Address A0h - Updated byte 0, 1, 128, 186, 192, 196, 212, 236.<br>Figure: Cable Jacket Labels - New label. |
| 2.0      | Dec. 31, 2017 | New product generation.                                                                                                                                                  |

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