Hitachi Cable America Inc.

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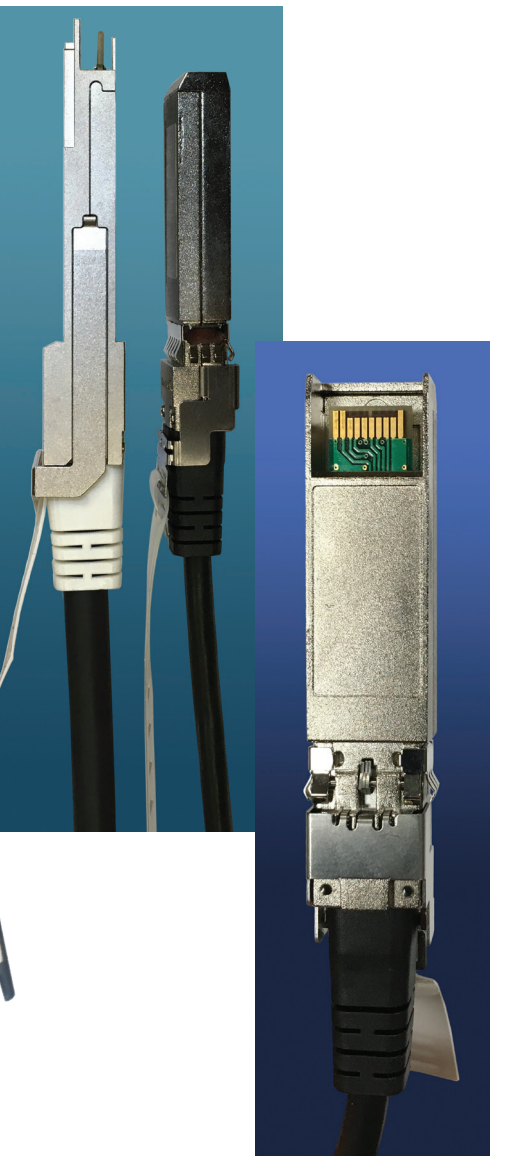


Direct Attach Cable Assemblies

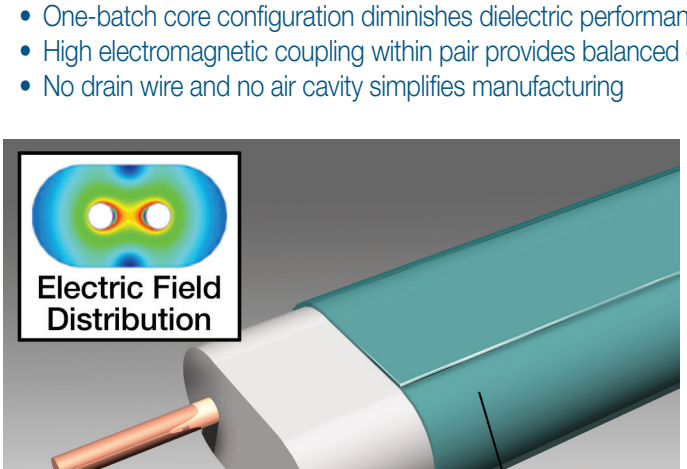
Copper Based Direct Attach Cables (DAC)

Regardless of the industry, the location, whether it is a data center or call center, commercial or industrial, it is an indisputable fact that bandwidth and data storage needs are always increasing. To satisfy our never ending hunger for more data and quicker access to it, technology manufacturers must constantly develop and release newer, faster technologies. One popular and proven technology is Direct Attach Cables. Direct Attach Cables offer pre-terminated connection solutions for 25Gbit/s, 50Gbit/s and 100 Gbit/s. Utilizing the same port as an optical transceiver, the copper based DAC is a more cost effective solution for short run applications, up to 5 meters, than fiber since it does not require power for signal conversion from electrons to photons.

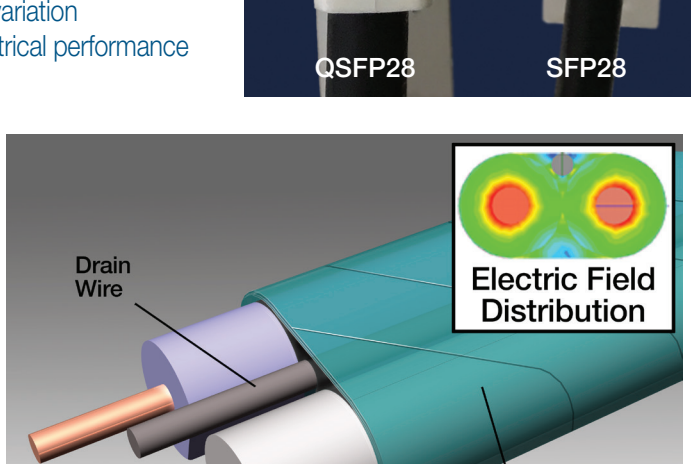
With the convenience of plug and play technology, Hitachi's family of Direct Attach Cables (DAC) delivers throughput that exceeds those of industry standards. Hitachi's patented OMNIBIT® high-performance twin-axial (twinax) cable designs offer very competitive performance. Hitachi's leading edge OMNIBIT® high-speed copper cable assemblies meet the highest performance levels (QSFP28 & SFP28) and are cost effective I/O solutions supporting Ethernet and InfiniBand applications. Hitachi's OMNIBIT® Technology for QSFP28 and SFP28 Direct Attach Copper cable assemblies provide a high-density, high-bandwidth solution with broadly recognized Hitachi performance and reliability. Hitachi's OMNIBIT® high-speed cable assemblies provide excellent performance and reliability as per SFF-8436 & IEEE 802.3bj at speeds up to 28Gbps per channel.

OMNIBIT® supports 25 Gbit/s interconnections

- One-batch core configuration diminishes dielectric performance variation
- High electromagnetic coupling within pair provides balanced electrical performance
- No drain wire and no air cavity simplifies manufacturing



Hitachi OMNIBIT®



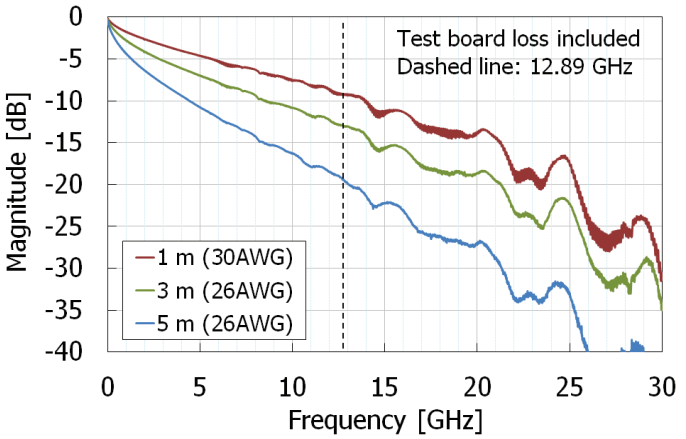
Conventional Cables

QSFP28 DIRECT ATTACH CABLE

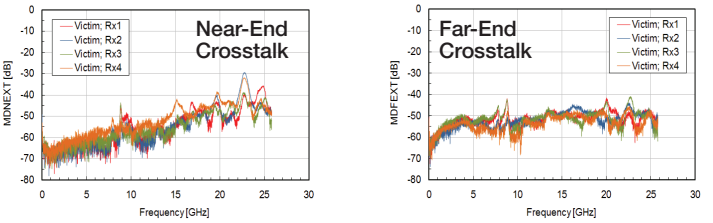
100G QSFP28 - 100G QSFP28

Features

- IEEE 802.3by 100GBASE-CR4 & InfiniBand EDR
- Reach for 25 Gbit/s/ch passive interconnection
  - 5 meters with 26AWG
  - 3 meters with 30AWG
- Excellent signal integrity, low insertion loss and low crosstalk
- Enabled by OMNIBIT® High Performance Twinax-Cable



SDD21 (Insertion Loss)



Crosstalk, 26AWG, 3 meters

Product Selection

AWG	Length [m]	Part Number	Standards[1]
30AWG	0.5	25QSFP30B–05	25GBASE-CR CA-25G-N (IEEE802.3by) InfiniBand® EDR 100GBASE-CR4 (IEEE802.3bj)
	1.0	25QSFP30B–10	
	2.0	25QSFP30B–20	
26AWG	1.5	25QSFP26C-15	25GBASE-CR CA-25G-N (IEEE802.3by) InfiniBand® EDR 100GBASE-CR4 (IEEE802.3bj)
	2.0	25QSFP26C–20	
	3.0	25QSFP26C–30	
	4.0	25QSFP26C-40	25GBASE-CR CA-25G-L (IEEE802.3by) 100GBASE-CR4 (IEEE802.3bj)
	5.0	25QSFP26C–50	

[1]To achieve the rated reach, passive cables meeting;
- 25GBASE-CR CA-25G-N do not require FEC,
- 25GBASE-CR CA-25G-L do require FEC on the switch/server mother board.

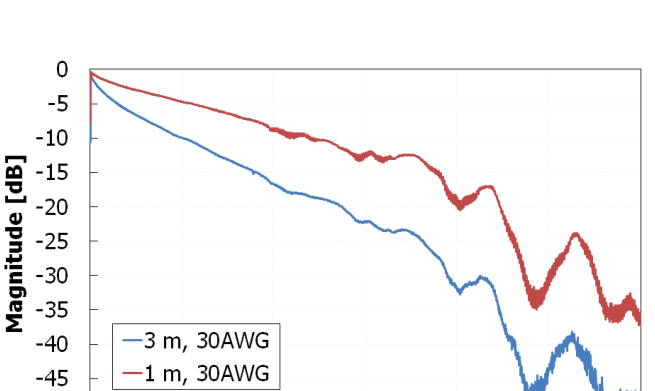
Hitachi recognizes that certain switch and server equipment manufacturers implement module identification lockout codes in their firmware. Suitability of these assemblies in those implementations is not guaranteed. Please contact your switch equipment vendor to determine suitability.

SFP28 DIRECT ATTACH CABLE

25G SFP28 - 25G SFP28

Features

- IEEE 802.3by
- Excellent signal integrity and low insertion loss
- Enabled by OMNIBIT® High Performance Twinax-Cable



SDD21 (Insertion Loss)

Applications

- 25G Server Cabling for Data Center Networks (25GbE)

Product Selection

AWG	Length [m]	Part Number	Standard[1]
30AWG	1.0	25SFP30B-10	25GBASE-CR CA-25G-N (IEEE802.3by)
	2.0	25SFP30B-20	
	3.0	25SFP30B-30	25GBASE-CR CA-25G-L (IEEE802.3by)
26AWG	2.0	25SFP26C-20	25GBASE-CR CA-25G-N (IEEE802.3by)
	3.0	25SFP26C-30	
	4.0	25SFP26C-40	25GBASE-CR CA-25G-L (IEEE802.3by)
	5.0	25SFP26C-50	

[1]To achieve the rated reach, passive cables meeting;
- 25GBASE-CR CA-25G-N do not require FEC,
- 25GBASE-CR CA-25G-L do require FEC on the switch/server mother board.

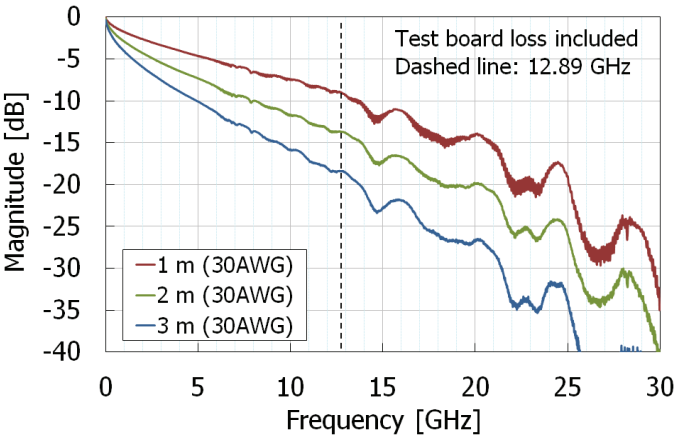
Hitachi recognizes that certain switch and server equipment manufacturers implement module identification lockout codes in their firmware. Suitability of these assemblies in those implementations is not guaranteed. Please contact your switch equipment vendor to determine suitability.

1x2 BREAKOUT CABLE

100G QSFP28 - 50G QSFP28

Features

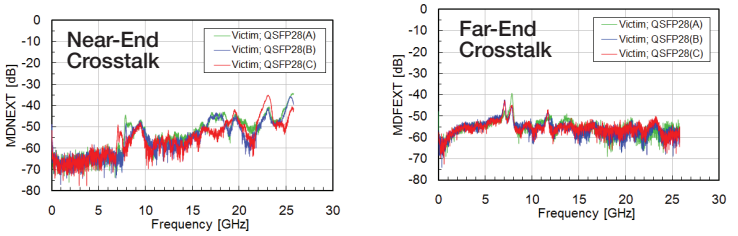
- 25G/50G Ethernet
- Excellent signal integrity, low insertion loss and low crosstalk
- Enabled by OMNIBIT® High Performance Twinax-Cable



SDD21 (insertion Loss)

Applications

- Switch-to-Server Cabling for Data Center Networks (50G)



Crosstalk, 30 AWG, 3 meters

Product Selection

AWG	Length [m]	Part Number	Standard[1]
30AWG	1.0	25B2P30B-10	25GBASE-CR CA-25G-N (IEEE802.3by)
	1.5	25B2P30B-15	
	2.0	25B2P30B-20	
	2.5	25B2P30B-25	25GBASE-CR CA-25G-L (IEEE802.3by)
	3.0	25B2P30B-30	
26AWG	1.0	25B2P26C-10	25GBASE-CR CA-25G-N (IEEE802.3by)
	1.5	25B2P26C-15	
	2.0	25B2P26C-20	
	2.5	25B2P26C-25	
	3.0	25B2P26C-30	

[1]To achieve the rated reach, passive cables meeting;
- 25GBASE-CR CA-25G-N do not require FEC,
- 25GBASE-CR CA-25G-L do require FEC on the switch/server mother board.

Hitachi recognizes that certain switch and server equipment manufacturers implement module identification lockout codes in their firmware. Suitability of these assemblies in those implementations is not guaranteed. Please contact your switch equipment vendor to determine suitability.

QSFP28 (A)

Pad	Symbol
1	GND
2	TX2n
3	TX2p
4	GND
5	TX4n
6	TX4p
7	GND
8	ModselL
9	ResetL
10	VccRX
11	SCL
12	SDA
13	GND
14	RX3p
15	RX3n
16	GND
17	RX1p
18	RX1n
19	GND
20	GND
21	RX2n
22	RX2p
23	GND
24	RX4n
25	RX4p
26	GND
27	ModPrsL
28	IntL
29	VccTX
30	Vcc1
31	LPMode
32	GND
33	TX3p
34	TX3n
35	GND
36	TX1p
37	TX1n
38	GND

QSFP28 (C)

Pad	Symbol	Pad	Symbol
1	GND	5	N.C.
2	TX2n	6	N.C.
3	TX2p	7	GND
4	GND	8	ModselL
11	SCL	9	ResetL
12	SDA	10	VccRX
13	GND	14	N.C.
16	GND	15	N.C.
17	RX1p	24	N.C.
18	RX1n	25	N.C.
19	GND	26	GND
20	GND	27	ModPrsL
21	RX2n	28	IntL
22	RX2p	29	VccTX
23	GND	30	Vcc1
35	GND	31	LPMode
36	TX1p	32	GND
37	TX1n	33	N.C.
38	GND	34	N.C.

QSFP28 (B)

Pad	Symbol	Pad	Symbol
1	GND	5	N.C.
2	TX2n	6	N.C.
3	TX2p	7	GND
4	GND	8	ModselL
11	SCL	9	ResetL
12	SDA	10	VccRX
13	GND	14	N.C.
16	GND	15	N.C.
17	RX1p	24	N.C.
18	RX1n	25	N.C.
19	GND	26	GND
20	GND	27	ModPrsL
21	RX2n	28	IntL
22	RX2p	29	VccTX
23	GND	30	Vcc1
35	GND	31	LPMode
36	TX1p	32	GND
37	TX1n	33	N.C.
38	GND	34	N.C.

Pin Function and Wiring Diagram for High-Speed Lanes

1x4 BREAKOUT CABLE

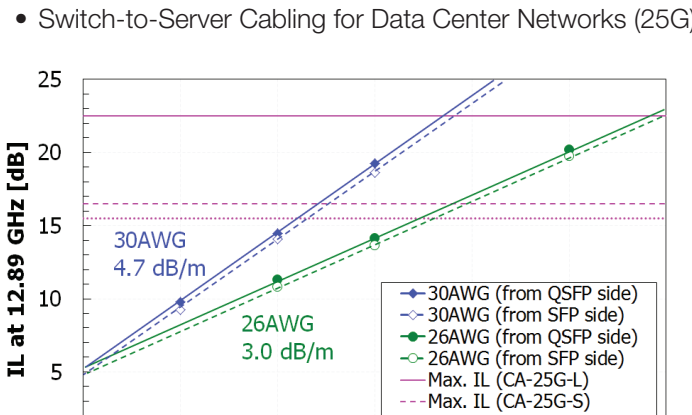
100G QSFP28 - 25G SFP28

Features

- IEEE 802.3by
- Excellent signal integrity, low insertion loss and low crosstalk
- Enabled by OMNIBIT® High Performance Twinax-Cable

Applications

- Switch-to-Server Cabling for Data Center Networks (25G)



Cable Length vs Insertion Loss

Product Selection

AWG	Length [m]	Part Number	Standard[1]
30AWG	1.0	25B4P30B-10	25GBASE-CR CA-25G-N (IEEE802.3by)
	2.0	25B4P30B-20	
	3.0	25B4P30B-30	25GBASE-CR CA-25G-L (IEEE802.3by)
26AWG	2.0	25B4P26C-20	25GBASE-CR CA-25G-N (IEEE802.3by)
	3.0	25B4P26C-30	
	4.0	25B4P26C-40	25GBASE-CR CA-25G-L (IEEE802.3by)
	5.0	25B4P26C-50	

[1]To achieve the rated reach, passive cables meeting;
- 25GBASE-CR CA-25G-N do not require FEC,
- 25GBASE-CR CA-25G-L do require FEC on the switch/server mother board.

Hitachi recognizes that certain switch and server equipment manufacturers implement module identification lockout codes in their firmware. Suitability of these assemblies in those implementations is not guaranteed. Please contact your switch equipment vendor to determine suitability.

QSFP28 (A)

Pad	Symbol
1	GND
2	TX2n
3	TX2p
4	GND
5	TX4n
6	TX4p
7	GND
8	ModselL
9	ResetL
10	VccRX
11	SCL
12	SDA
13	GND
14	RX3p
15	RX3n
16	GND
17	RX1p
18	RX1n
19	GND
20	GND
21	RX2n
22	RX2p
23	GND
24	RX4n
25	RX4p
26	GND
27	ModPrsL
28	IntL
29	VccTX
30	Vcc1
31	LPMode
32	GND
33	TX3p
34	TX3n
35	GND
36	TX1p
37	TX1n
38	GND

SFP28 (D)

Pad	Symbol	Pad	Symbol
11	VeeR	10	VeeR
12	RD-	9	RS1
13	RD+	8	LOS
14	VeeR	7	RS0
15	VccR	6	MOD_ABS
16	VccT	5	SCL
17	VeeT	4	SDA
18	TD+	3	TX_Disable
19	TD-	2	TX_Fault
20	VeeT	1	VeeT

SFP28 (E)

Pad	Symbol	Pad	Symbol
11	VeeR	10	VeeR
12	RD-	9	RS1
13	RD+	8	LOS
14	VeeR	7	RS0
15	VccR	6	MOD_ABS
16	VccT	5	SCL
17	VeeT	4	SDA
18	TD+	3	TX_Disable
19	TD-	2	TX_Fault
20	VeeT	1	VeeT

SFP28 (B)

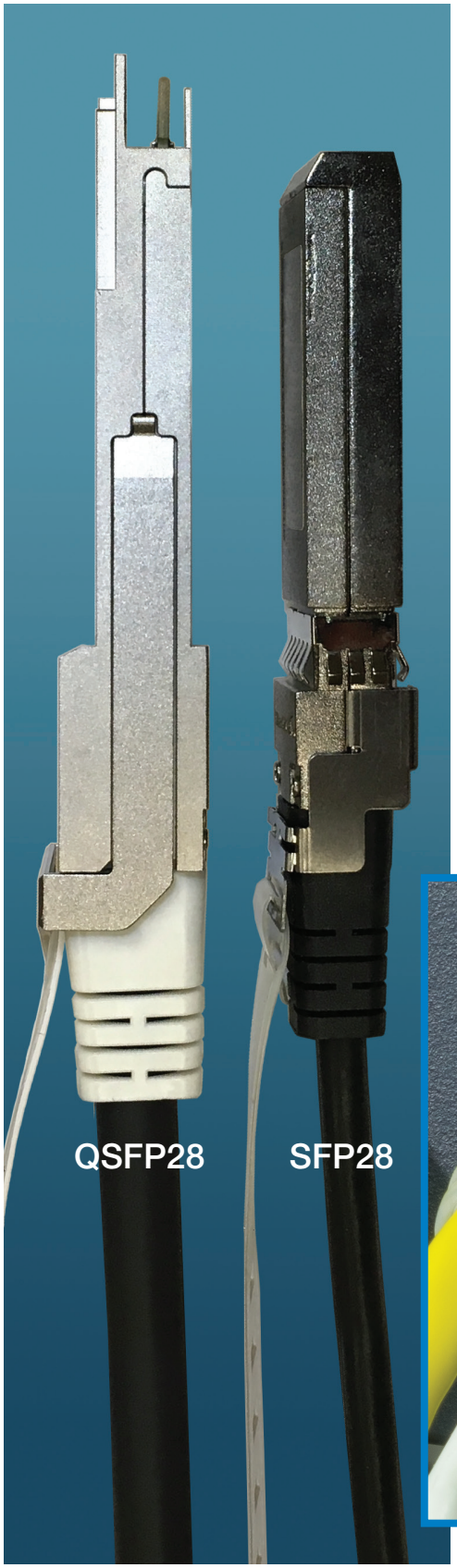
Pad	Symbol	Pad	Symbol
11	VeeR	10	VeeR
12	RD-	9	RS1
13	RD+	8	LOS
14	VeeR	7	RS0
15	VccR	6	MOD_ABS
16	VccT	5	SCL
17	VeeT	4	SDA
18	TD+	3	TX_Disable
19	TD-	2	TX_Fault
20	VeeT	1	VeeT

SFP28 (C)

Pad	Symbol	Pad	Symbol
11	VeeR	10	VeeR
12	RD-	9	RS1
13	RD+	8	LOS
14	VeeR	7	RS0
15	VccR	6	MOD_ABS
16	VccT	5	SCL
17	VeeT	4	SDA
18	TD+	3	TX_Disable
19	TD-	2	TX_Fault
20	VeeT	1	VeeT

Pin Function and Wiring Diagram for High-Speed Lanes

Direct Attach Cables



SFP28 and QSFP28 Defined

SFP28 (Small Form Pluggable) is a title applied to both a network connector and a network port. SFP28 is a type of link utilized for both fiber cables, and copper-based Direct Attach Cables (DACs). As a connector, SFP28 defines a type of enhanced hot-swappable connector designed to support switch and server data rates of 25 Gbit/s Ethernet. It contains 20 pins. It is backwards compatible with all SFP ports.

Intended for short runs (up to 5 meters), Hitachi's copper DACs featuring SFP28 connectors can each support single channels with data rates up to 25 Gbit/s. Integrating multiple SFP28 connectors with a single QSFP28 connector can enable support of up to 100 Gbit/s per cable assembly (4 x 25G channels). This 1x4 configuration is advantageous since four 10/25G servers can be consolidated onto one 40/100G switch.

QSFP28 (Quad Small Form Pluggable), like SFP28 refers to both a plug and port. As the name implies, it can accommodate 4x the SFP28 data rate through the utilization of 4 distinct data channels. The connector is slightly larger than an SFP28 connector. It contains 38 pins with 4 high-speed TX pairs and 4 high-speed RX pairs. Like the SFP28 connector, it can be utilized for both fiber cables, and copper-based DACs. Hitachi's copper DACs featuring QSFP28 connectors are rate and protocol agnostic and support data rates of 25, 50 and 100 Gbit/s Ethernet as well as InfiniBand EDR.

Applications for DACs

Direct Attach Cables are ideal for high density, high speed I/O data center applications in the networking, telecom and data storage markets where maximum overall network efficiency and lower overall cost are desired.

WORLDWIDE COVERAGE

ethernet alliance member

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