





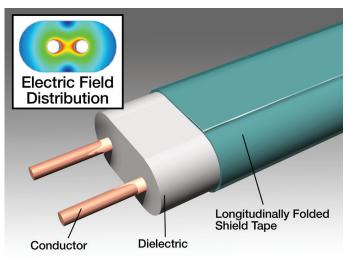
# Copper Based Direct Attach Cables (DAC)

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®

Conductor Dielectric Helically Wrapped Shield Tape

Drain

Wire

# **Conventional Cables**

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**Electric Field** 

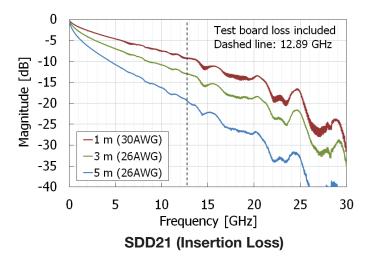
Distribution



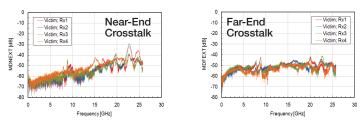
# **QSFP28 DIRECT ATTACH CABLE** 100G QSFP28 - 100G QSFP28

#### **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<sup>®</sup> High Performance Twinax-Cable







Crosstalk, 26AWG, 3 meters

#### **Product Selection**

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

<sup>1</sup>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.

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#### Hitachi Cable America Inc.

# 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





#### Applications

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

#### **Product Selection**

AWG	Length [m]	Part Number	Standard <sup>1</sup>
	1.0	25SFP30B-10	
30AWG	2.0	25SFP30B-20	25GBASE-CR CA-25G-N (IEEE802.3by)
	3.0	25SFP30B-30	25GBASE-CR CA-25G-L (IEEE802.3by)
	2.0	25SFP26C-20	
06414/0	3.0	25SFP26C-30	25GBASE-CR CA-25G-N (IEEE802.3by)
26AWG	4.0	25SFP26C-40	
	5.0	25SFP26C-50	25GBASE-CR CA-25G-L (IEEE802.3by)

<sup>1</sup>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.

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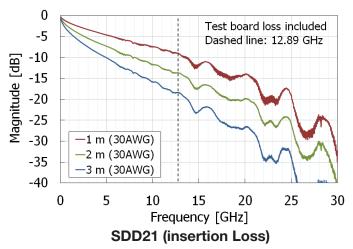
### Hitachi Cable America Inc.

3

# 1x2 BREAKOUT CABLE 100G QSFP28 - 50G QSFP28

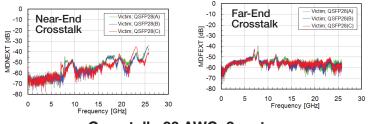
#### Features

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



### Applications

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



Crosstalk, 30 AWG, 3 meters

### **Product Selection**

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

<sup>1</sup>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.



SFP2	28 (A)						Pad	8 (C) Symbol	Pad	Symbo
Pad	Symbol	-					1 Pad	GND	<b>Pad</b>	N.C.
1	GND	-					2	TX2n	6	N.C.
2	TX2n	-		Г			2	TX2n TX2p		GND
2	TX2p		7				4			ModselL
4	GND							GND SCL	8	
5	TX4n	-					11 12	SCL	10	ResetL VccRX
6	TX4p						12			N.C.
7	GND						13	GND GND	14 15	N.C. N.C.
8	ModselL	- 1					16		24	N.C.
9	ResetL	- 1					17	RX1p RX1n	24	N.C.
10	VccRX	- 1			ΙΙГ		18	GND	25	GND
11	SCL	- 1					20	GND	26	ModPrsL
12	SDA	- 1					20		27	
12	GND	-					21	RX2n		IntL
13	RX3p	- 1				<u> </u>	22	RX2p	29 30	VccTX Vcc1
14	RX3p RX3n							GND		
15	GND				Ш		35	GND	31	LPMode
17	RX1p	- 1					36 37	TX1p TX1n	32 33	GND N.C.
	RX1p RX1n					<u> </u>	37			
							38	GND	34	N.C.
			$\square$							-
18 19	GND		$\square$							
19 20	GND GND									
19 20 21	GND GND RX2n								1	
19 20 21 22	GND GND RX2n RX2p	-								
19 20 21 22 23	GND GND RX2n RX2p GND							28 (B)		
19 20 21 22 23 24	GND GND RX2n RX2p GND RX4n						QSFP	28 (B)	Pad	Sumbo
19 20 21 22 23 24 25	GND GND RX2n RX2p GND RX4n RX4p						QSFP: Pad	Symbol	Pad	
19 20 21 22 23 24 25 26	GND GND RX2n RX2p GND RX4n RX4p GND						QSFP Pad	Symbol GND	5	N.C.
19 20 21 22 23 24 25 26 27	GND GND RX2n RX2p GND RX4n RX4p GND ModPrsL						QSFP Pad 1 2	Symbol GND TX2n	5 6	N.C. N.C.
19 20 21 22 23 24 25 26 27 28	GND GND RX2n RX2p GND RX4n RX4p GND ModPrsL IntL						QSFP Pad 1 2 3	Symbol GND TX2n TX2p	5 6 7	N.C. N.C. GND
19 20 21 22 23 24 25 26 27 28 29	GND GND RX2n RX2p GND RX4n RX4p GND ModPrsL IntL VccTX						QSFP. <b>Pad</b> 1 2 3 4	Symbol GND TX2n TX2p GND	5 6 7 8	N.C. N.C. GND ModselL
19 20 21 22 23 24 25 26 27 28 29 30	GND GND RX2n RX2p GND RX4n RX4p GND ModPrsL IntL VccTX Vcc1						QSFP. <b>Pad</b> 1 2 3 4 11	Symbol GND TX2n TX2p GND SCL	5 6 7 8 9	N.C. N.C. GND ModselL ResetL
19 20 21 22 23 24 25 26 27 28 27 28 29 30 31	GND GND RX2n RX2p GND RX4n RX4p GND ModPrsL IntL VccTX Vcc1 LPMode						QSFP. <b>Pad</b> 1 2 3 4 11 12	Symbol GND TX2n TX2p GND SCL SDA	5 6 7 8 9 10	N.C. N.C. GND ModselL ResetL VccRX
19 20 21 22 23 24 25 26 27 28 29 30 31 32	GND GND RX2n RX2p GND RX4n RX4p GND ModPrsL IntL VccTX Vcc1 LPMode GND						QSFP. <b>Pad</b> 1 2 3 4 111 122 13	Symbol GND TX2n TX2p GND SCL SDA GND	5 6 7 8 9 10 14	N.C. N.C. GND ModselL ResetL VccRX N.C.
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33	GND GND RX2n RX2p GND RX4n RX4p GND ModPrsL IntL VccTX Vcc1 LPMode GND TX3p						QSFP Pad 1 2 3 4 11 12 13 16	Symbol GND TX2n TX2p GND SCL SDA GND GND	5 6 7 8 9 10 14 15	N.C. N.C. GND ModselL ResetL VccRX N.C. N.C.
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 33 33	GND GND RX2n RX2p GND RX4n RX4p GND ModPrsL IntL VccTX Vcc1 LPMode GND TX3p TX3n						QSFP Pad 1 2 3 4 11 12 13 16 17	Symbol GND TX2n TX2p GND SCL SDA GND GND RX1p	5 6 7 8 9 10 14 15 24	N.C. N.C. GND ModselL ResetL VccRX N.C. N.C. N.C.
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 33 34 35	GND GND RX2n RX2p GND RX4n RX4p GND ModPrsL IntL VccTX Vcc1 LPMode GND TX3p TX3n GND						QSFP Pad 1 2 3 4 11 12 13 16 17 18	Symbol GND TX2n TX2p GND SCL SDA GND RX1p RX1p RX1n	5 6 7 8 9 10 14 15 24 25	N.C. N.C. GND ModselL ResetL VccRX N.C. N.C. N.C. N.C. N.C.
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36	GND GND RX2n RX2p GND RX4n RX4p GND ModPrsL IntL VccTX Vcc1 LPMode GND TX3p TX3n GND TX1p						QSFP Pad 1 2 3 4 11 12 13 16 17 18 19	Symbol GND TX2n TX2p GND SCL SDA GND GND RX1p RX1n GND	5 6 7 8 9 10 14 15 24 25 26	N.C. N.C. GND ModselL ResetL VccRX N.C. N.C. N.C. N.C. GND
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37	GND GND RX2n RX2p GND RX4n RX4p GND ModPrsL IntL VccTX Vcc1 LPMode GND TX3p TX3n GND TX1p TX1n						QSFP: Pad 1 2 3 4 11 12 13 16 17 18 19 20	Symbol GND TX2n TX2p GND SCL SDA GND GND RX1p RX1n GND GND	5 6 7 8 9 10 14 15 24 25 26 27	N.C. N.C. GND ModselL ResetL VccRX N.C. N.C. N.C. N.C. GND ModPrsL
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37	GND GND RX2n RX2p GND RX4n RX4p GND ModPrsL IntL VccTX Vcc1 LPMode GND TX3p TX3n GND TX1p						QSFP: Pad 1 2 3 4 11 12 13 16 17 18 19 20 21	Symbol GND TX2n TX2p GND SCL SDA GND RX1p RX1n GND GND RX2n	5 6 7 8 9 10 14 15 24 25 26 27 28	N.C. N.C. GND ModselL ResetL VccRX N.C. N.C. N.C. N.C. GND ModPrsL IntL
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37	GND GND RX2n RX2p GND RX4n RX4p GND ModPrsL IntL VccTX Vcc1 LPMode GND TX3p TX3n GND TX1p TX1n						QSFP Pad 1 2 3 4 11 12 13 16 17 18 19 20 20 21 22	Symbol GND TX2n TX2p GND SCL SDA GND GND RX1p RX1n GND GND RX2n RX2p	5 6 7 8 9 10 14 15 24 25 26 27 28 29	N.C. N.C. GND ModselL ResetL VccRX N.C. N.C. N.C. N.C. GND ModPrsL IntL VccTX
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37	GND GND RX2n RX2p GND RX4n RX4p GND ModPrsL IntL VccTX Vcc1 LPMode GND TX3p TX3n GND TX1p TX1n						QSFP Pad 1 2 3 4 4 11 12 13 16 17 18 19 20 21 22 22 23	Symbol GND TX2n TX2p GND SCL SDA GND GND RX1p RX1n GND GND RX1n GND RX2p GND	5 6 7 8 9 10 14 15 24 25 26 27 28 29 30	N.C. N.C. GND ModselL ResetL VccRX N.C. N.C. N.C. N.C. M.C. ModPrsL IntL VccTX VccTX
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37	GND GND RX2n RX2p GND RX4n RX4p GND ModPrsL IntL VccTX Vcc1 LPMode GND TX3p TX3n GND TX1p TX1n						QSFP. Pad 1 2 3 4 11 12 13 16 17 18 19 20 21 22 23 35	Symbol GND TX2n TX2p GND SCL SDA GND GND GND RX1p RX1n GND GND RX2n RX2n RX2n RX2p GND GND GND	5 6 7 8 9 10 14 15 24 25 26 27 28 29 30 31	N.C. N.C. GND ModselL ResetL VccRX N.C. N.C. N.C. N.C. ModPrsL IntL VccTX Vcc1 LPMode
19 20	GND GND RX2n RX2p GND RX4n RX4p GND ModPrsL IntL VccTX Vcc1 LPMode GND TX3p TX3n GND TX1p TX1n						QSFP. Pad 1 2 3 4 11 12 13 16 17 18 19 20 21 22 23 35 36	Symbol GND TX2n TX2p GND SCL SDA GND GND RX1p RX1n GND RX1n GND RX2n RX2n RX2n RX2p GND GND TX1p	5 6 7 8 9 10 14 15 24 25 26 27 28 29 30 31 32	N.C. GND ModselL ResetL VccRX N.C. N.C. N.C. M.C. GND ModPrsL IntL VccTX Vcc1 LPMode GND
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37	GND GND RX2n RX2p GND RX4n RX4p GND ModPrsL IntL VccTX Vcc1 LPMode GND TX3p TX3n GND TX1p TX1n						QSFP. Pad 1 2 3 4 11 12 13 16 17 18 19 20 21 22 23 35	Symbol GND TX2n TX2p GND SCL SDA GND GND GND RX1p RX1n GND GND RX2n RX2n RX2n RX2p GND GND GND	5 6 7 8 9 10 14 15 24 25 26 27 28 29 30 31	N.C. N.C. GND ModselL ResetL VccRX N.C. N.C. N.C. N.C. N.C. ModPrsL IntL VccTX Vcc1 LPMode

#### Pin Function and Wiring Diagram for High-Speed Lanes

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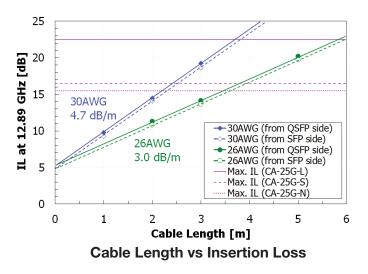
# **1x4 BREAKOUT CABLE** 100G QSFP28 - 25G SFP28

#### **Features**

- IEEE 802.3bv
- Excellent signal integrity, low insertion loss and low crosstalk •
- Enabled by OMNIBIT<sup>®</sup> High Performance Twinax-Cable

# **Applications**

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





AWG	Length [m]	Part Number	Standard <sup>1</sup>			
	1.0	25B4P30B-10				
30AWG	2.0	25B4P30B-20	25GBASE-CR CA-25G-N (IEEE802.3by)			
	3.0	25B4P30B-30	25GBASE-CR CA-25G-L (IEEE802.3by)			
	2.0	25B4P26C-20	25GBASE-CR CA-25G-N (IEEE802.3by)			
26AWG	3.0	25B4P26C-30	2566ASE-CR CA-256-N (IEEE602.30)			
ZOAWG	4.0	25B4P26C-40	25GBASE-CR CA-25G-L (IEEE802.3by)			
	5.0	25B4P26C-50	25GBASE-CR CA-25G-L (IEEE602.3Dy)			

<sup>1</sup>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.

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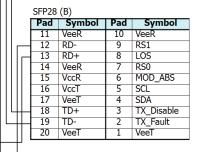
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1	Symbol GND				
2	TX2n				
2	TX2p				
3	GND				
5	TX4n		$ _{r}$		
6	TX40 TX4p	T	Π	_	
7	GND	H	Ħ	T	٦
8	ModselL	1			
9	ResetL				
10	VccRX				
11	SCL				
12	SDA				
13	GND				
13	RX3p	Ш	Ц		L
15	RX3n				
16	GND	П			
17	RX1p				
18	RX1n				
19	GND	1			
20	GND	1			_
21	RX2n	Ш			L
22	RX2p	4			Ļ
23	GND	1			
24	RX4n				
25	RX4p	Ш			
26	GND	11			
27	ModPrsL	11			
28	IntL				
29	VccTX	1			
30	Vcc1	11			
31	LPMode	11			
32	GND	11			
33	ТХ3р	Ш			
34	TX3n	<u> </u>	J		
35	GND	1			
36	TX1p	1			
37	TX1n	⊢			
38	GND	4			

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						

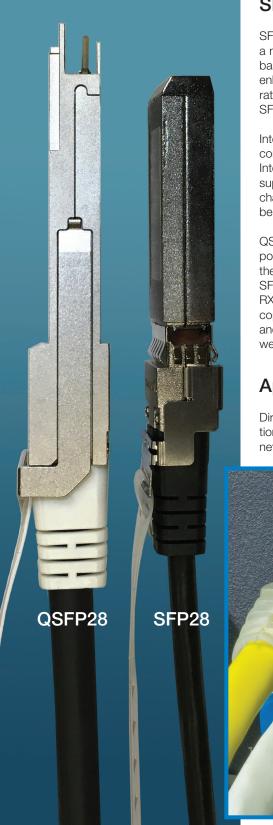
SFP28	(E)		
Pad	Symbol	Pad	Symbol
11	VeeR	10	VeeR
 12	RD-	9	RS1
 13	RD+	8	LOS
14	VeeR	7	RS0
15	VccR	6	MOD_ABS
16	VccT	5	SCL
17	VeeT	4	SDA
 18	TD+	3	TX_Disable
 19	TD-	2	TX_Fault
20	VeeT	1	VeeT



SFP28 (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 copperbased 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.



**O Hitachi Cable America Inc.** 

6







#### Hitachi Cable America Inc.

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