ETU-LINK®
Optical Communication System

12G Ext MiniSAS HD 4X Direct Attach Passive Copper Cables
MINI SAS HD 4X TO MINI SAS HD 4X
(SF-F8644 TO SFF-8644)

- Compliant with SFF- 8644 SFF8614 and SAS3.0
- Up to 12.0Gbps data rate per Channel
- Up to 5m tansmission
- Operating temperature: 0~70℃
- RoHS compliant

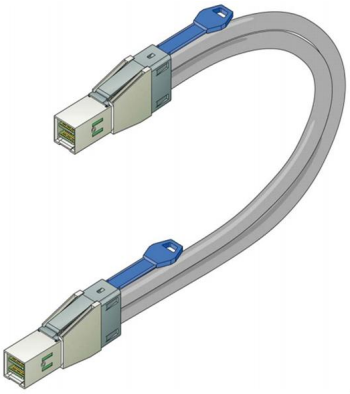


Figure 01 — SAS external cable assembly with Mini SAS HD 4x cable plug connectors

Applications

- 12G Ethernet

Benefits

- Cost-effective copper solution
- Lowest total system power solution
- Lowest total system EMI solution
- Optimized design for Signal Integrity

General Description

MINI SASHD 4X (Ext) Direct Attach Cables are compliant with the SFF -8644 specifications. Various choices of wire gauge are available from 30 to 24 AWG with various choices of cable length (up to 5m).

Pin Function Definition

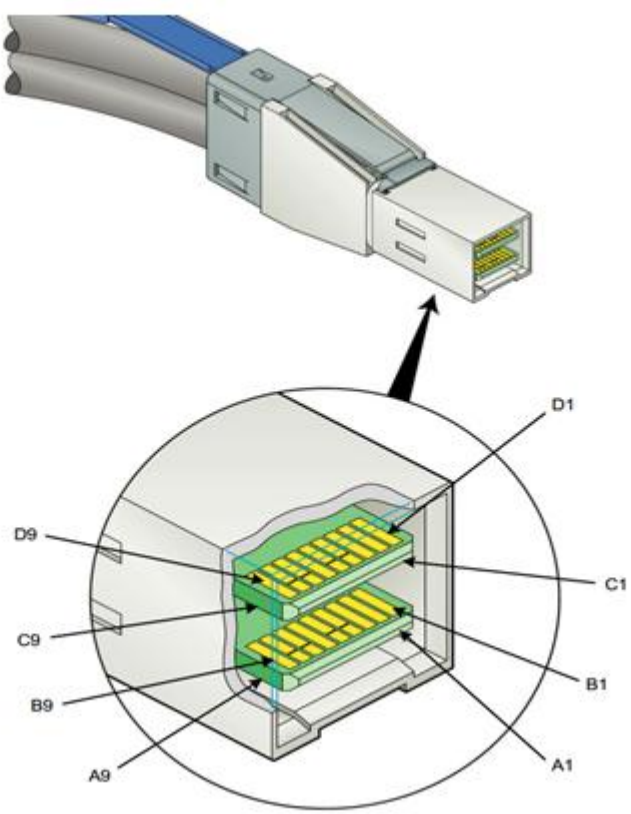


Table 19 - - Mini SAS 4x connector pin assignments and physical link usage

Signal	Pin usage based on number of physical links supported by the cable assembly				Mating level [a]
	One	Two	Three	Four	
RX 0+	A2	A2	A2	A2	Third
RX 0-	A3	A3	A3	A3	
RX 1+	N/C	A5	A5	A5	
RX 1-	N/C	A6	A6	A6	
RX 2+	N/C	N/C	A8	A8	
RX 2-	N/C	N/C	A9	A9	
RX 3+	N/C	N/C	N/C	A11	
RX 3-	N/C	N/C	N/C	A12	
TX 0+	B2	B2	B2	B2	
TX 0-	B3	B3	B3	B3	
TX1+	N/C	B5	B5	B5	
TX 1-	N/C	B6	B6	B6	
TX 2+	N/C	N/C	B8	B8	
TX 2-	N/C	N/C	B9	B9	
TX 3+	N/C	N/C	N/C	B11	
TX 3-	N/C	N/C	N/C	B12	

SIGNAL GROUND	A1, A4, A7, A10, A13 B1, B4, B7, B10, B13	First
CHASSIS GROUND	Housing	N/A
Key: N/C = not connected.		
[a] The mating level indicates the physical dimension of the contact (see SFF -8086).		

SIGNAL GROUND shall not be connected to CHASSIS GROUND in the connector when used in a cable assembly.

Table 22—Mini SAS HD 4x connector pin assignments and physical link usage

Signal	Pin usage based on number of physical links supported by the cable assembly				Mating level [a]
	One	Two	Three	Four	
RX 0-	B5	B5	B5	B5	Third
RX 0+	B4	B4	B4	B4	
RX 1-	N/C	A5	A5	A5	
RX 1+	N/C	A4	A4	A4	
IntL [b]	A2	A2	A2	A2	Second
Reserved [b]	A1	A1	A1	A1	
ModPrsL [b]	B2	B2	B2	B2	
Vact [b]	B1	B1	B1	B1	
RX 2-	N/C	N/C	B8	B8	Third
RX 2+	N/C	N/C	B7	B7	
RX 3-	N/C	N/C	N/C	A8	
RX 3+	N/C	N/C	N/C	A7	
TX 0-	D5	D5	D5	D5	Third
TX 0+	D4	D4	D4	D4	
TX1-	N/C	C5	C5	C5	
TX 1+	N/C	C4	C4	C4	
SDA [b]	C2	C2	C2	C2	Second
SCL [b]	C1	C1	C1	C1	
Vman [b]	D2	D2	D2	D2	
Vact [b]	D1	D1	D1	D1	
TX2-	N/C	N/C	D8	D8	Third
TX 2+	N/C	N/C	D7	D7	
TX 3-	N/C	N/C	N/C	C8	
TX 3+	N/C	N/C	N/C	C7	
SIGNAL GROUND	A3, A6, A9, B3, B6, B9, C3, C6, C9, D3, D6, D9				First
Key: N/C = not connected					
a The mating level indicates the physical dimension of the contact (see SFF -8644). b Table 23 (see 5435.27) defines the connection requirements of this signal.					

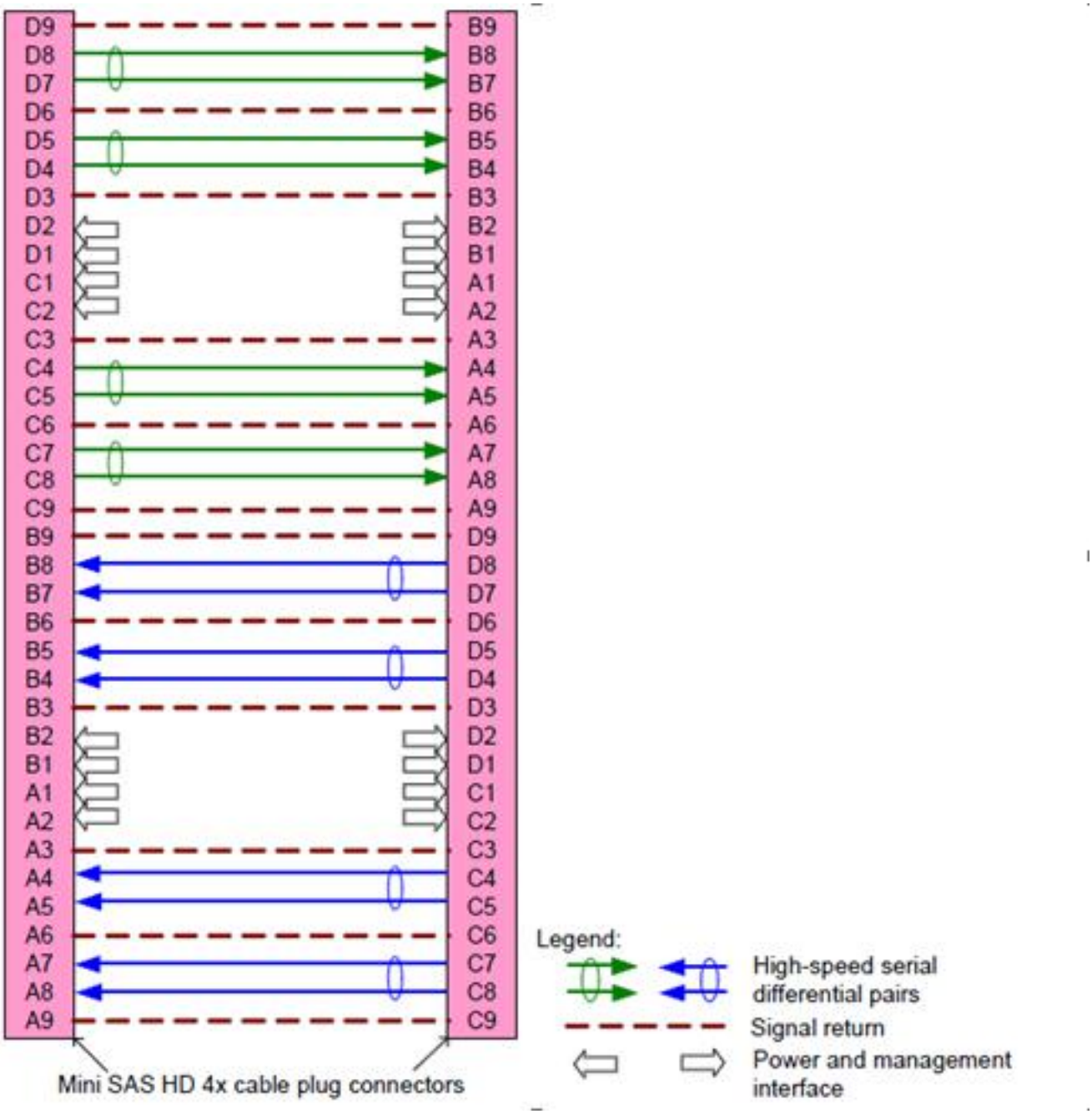


Figure 02—SAS external cable assembly - Mini SAS HD 4x

General Product Characteristics & High Speed Characteristics

Characteristic [a] [b]	Units	Value
Differential impedance (nominal)	Ω	100
Bulk cable or backplane:		

Differential characteristic impedance [d e]	Ω	100
Mated connectors:		
Differential characteristic impedance [f]	Ω	100
Passive cable assembly and backplane:		
Maximum propagation delay [C]	ns	53
Minimum $\lvert S_{DD21} \rvert$ for internal cable assemblies from 10 MHz to 4500 MHz [g]	dB	-6
Minimum $\lvert S_{DD21} \rvert$ for internal cable assemblies from 4 500 MHz to 9000 MHz [g h]	dB	-11
Minimum $\lvert S_{DD21} \rvert$ for external cable assemblies and backplanes	See 5.5	
Mini SAS 4x active cable assembly:		
Maximum propagation delay [i]	ns	133
Differential characteristic impedance [f]	Ω	100
Managed cable assembly:		
Maximum propagation delay [j]	ns	510
Differential characteristic impedance [f]	Ω	100

a All measurements are made through mated connector pairs.

b The equivalent maximum TDR rise time from 20 % to 80 % shall be 70 ps. Filtering may be used to obtain the equivalent rise time. The filter consists of the two-way launch/return path of the test fixture, the two-way launch/return path of the test cable, and the software or hardware filtering of the TDR scope. The equivalent rise time is the rise time of the TDR scope output after application of all filter components. When configuring software or hardware filters of the TDR scope to obtain the equivalent rise time, filtering effects of test cables and test fixtures shall be included.

c This is based on propagation delay for a 10 m Mini SAS 4x passive cable assembly. See SPL-3 for STP flow control details.

d The impedance measurement identifies the impedance mismatches present in the bulk cable or backplane when terminated in its characteristic impedance. This measurement excludes mated connectors at both ends of the bulk cable or backplane, when present, but includes any intermediate connectors or splices.

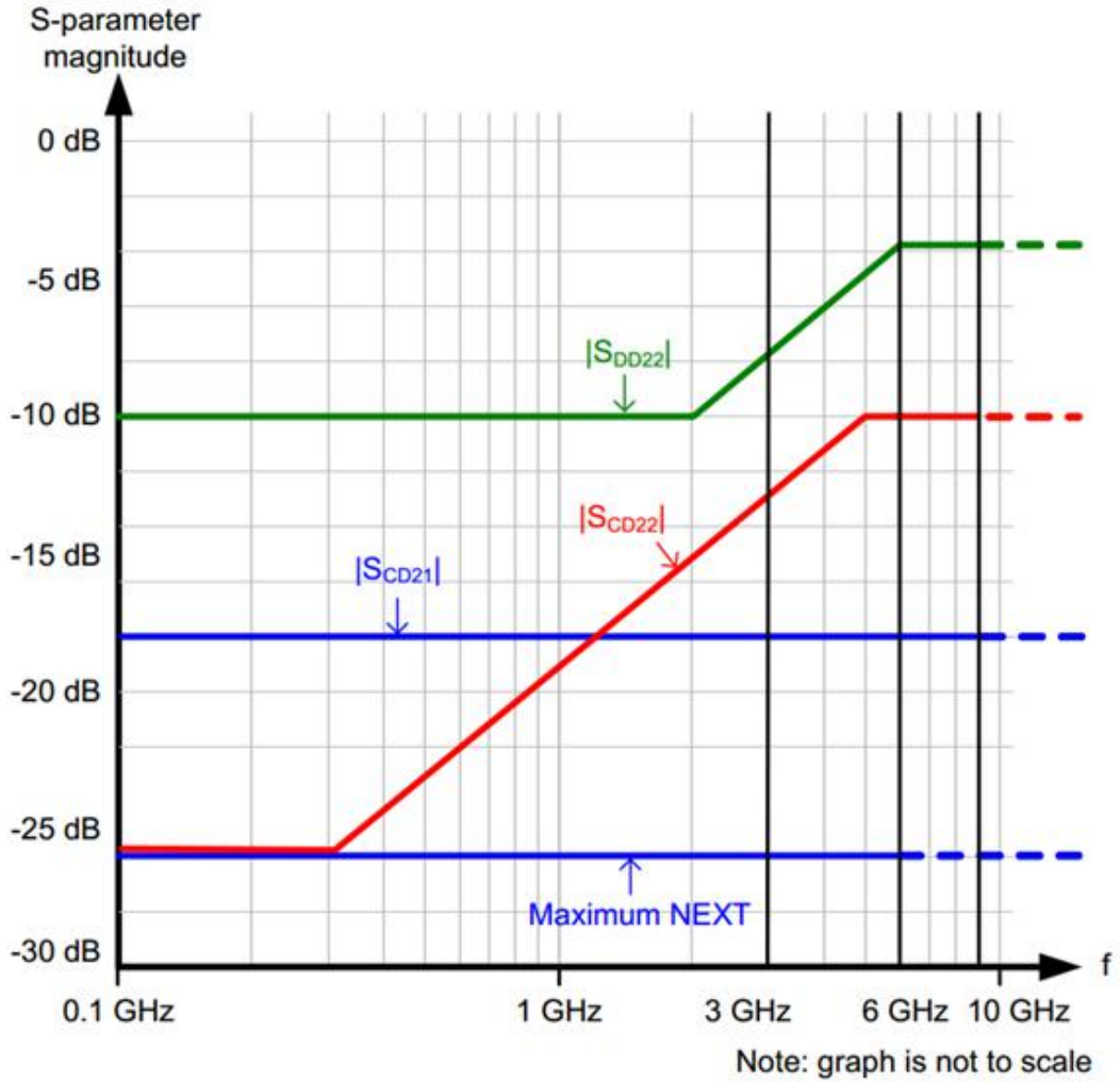


Figure 97 — Passive TxRx connection $|S_{DD22}|$, $|S_{CD22}|$, $|S_{CD21}|$, and NEXT limits

Figure 113 shows the reference transmitter test load $IS_{DD21}(f)|$ up to 6 GHz.

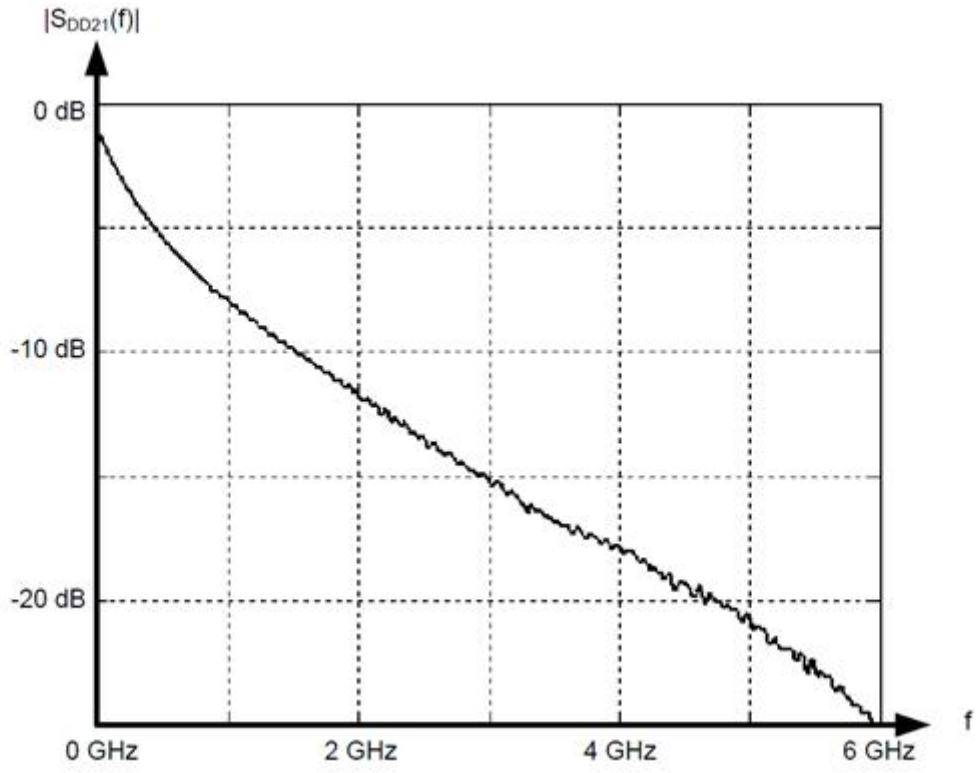


Figure 113 — Trained 1.5 Gbits, 3 Gbit/s, and 6 Gbits reference transmitter test load $|S_{DD21}(f)|$ up to 6 GHz

S-parameter limits are calculated per the following formula:

Measured value < max [L, min [H, N+ 13.3 x $\log_{10}$(f / 3 GHz)]]

where:

L is the minimum value (i.e., the low frequency asymptote);

H is the maximum value (i.e., the high frequency asymptote);

N is the value at 3 GHz;

f is the frequency of the signal in Hz;

max[A, B] is the maximum of A and B; and

min[A, B] is the minimum of A and B.

The frequency for N is based on the Nyquist at 6 Gbit/s.

Table 40 defines the maximum limits for S-parameters of the transmitter device.

Table 40 — Maximum limits for S-parameters at IT_S or CT_S

Characteristic [a b]	L [c] (dB)	N [c] (dB)	H [c] (dB)	S [c] (dB / decade)	f_{min} [c] (MHz)	f_{max} [c] (GHz)
$\|S_{CC22}\|$	-6.0	-5.0	-1.0	13.3	100	6.0
$\|S_{DD22}\|$	-10	-7.9	-3.9	13.3	100	6.0
$\|S_{CD22}\|$	-26	-12.7	-10	13.3	100	6.0

a For S-parameter measurements, the transmitter device under test shall transmit a repeating 0011b pattern or 1100b pattern (e.g., D24.3)(see the phy test patterns in the Protocol Specific diagnostic page in SPL-3). The amplitude applied by the test equipment shall be less than -4.4 dBm (i.e, 190 mV zero to peak) per port (see F.11.4.2).

b $|S_{DC22}|$ is not specified.

c See figure 4 for definitions of L, N, H, S, f_{min}, and f_{max}.

Table 26 — Maximum limits for S-parameters of the passive TxRx connection between IT_S and IR or CT_S and CR

Characteristic [a b c d]	L [e] (dB)	N [e] (dB)	H [e] (dB)	S [e] (dB / decade)	f_{min} [e] (MHz)	f_{max} [e f] (GHz)	f_{max} [e g] (GHz)
[20 x $\log_{10}\|S_{CD21}\|$)]-[20 x $\log_{10}\|S_{DD21}\|$)]	-10			0	100	6.0	9.0
Maximum near-end crosstalk (NEXT) for each receive signal pair [f h]	-26			0	100	6.0	
20 x $\log_{10}\|S_{DD22}\|$)	-10	-7.9	-3.9	13.3	100	6.0	9.0
20 x $\log_{10}\|S_{DD22}\|$)	-26	-12.7	-10	13.3	100	6.0	9.0
20 x $\log_{10}\|S_{CD21}\|$)	-18			0	100	6.0	9.0
Insertion loss to crosstalk ratio (ICR(f) [g h i j]	-15			0	100		6.0

a All measurements are made through mated connector pairs.

b Specifications apply to any combination of cable assemblies and backplanes that are used to form a passive TxRx connection.

c $|S_{CC22}|$ and $|S_{DC22}|$ are not specified.

d For 12 Gbit/s, these characteristics only apply to cable assemblies between CTs and CR compliance

points. 12 Gbit/s passive cable assemblies shall also comply with passive TxRx connection characteristics for trained 12 Gbit/s (see 5.5.6).

e See figure 4 in 5.2 for definitions of L. N, H. S. f_{min}. and f_{max}.

f Only applies for 1.5 Gbit/s, 3 Gbit/s, and 6 Gbit/s.

g Only applies for 12 Gbit/s.

h Determine all near-end and far-end significant crosstalk sources. The sum of the crosstalk transfer ratios is measured in the frequency domain. The following equation details the summation process of the valid near-end crosstalk sources:

$$TotalNEXT(f) = 10 \times \log \sum_{1}^{n} 10^{(NEXT(f)/10)}$$

where:

f is frequency; and

n is the number of the near-end crosstalk source.

All NEXT values expressed in dB format in a passive transfer network shall have negative dB magnitude.

The following equation details the summation process of the valid far-end crosstalk sources:

$$TotalFEXT(f) = 10 \times \log \sum_{1}^{n} 10^{(FEXT(f)/10)}$$

where:

f is frequency; and

N is the number of the far-end crosstalk source.

i All FEXT values expressed in dB format in a passive transfer network shall have negative dB magnitude.

j The following equation defines the insertion loss to crosstalk ratio;

$$ICR(f) = [10 \times \log(10^{TotalNEXT(f)/10} + 10^{TotalFEXT(f)/10})] - [20 \times \log_{10}(|S_{DD21}|)]$$

where:

f is frequency;

TotalNEXT(f) is near-end crosstalk;

TotalFEXT(f) is far-end crosstalk; and

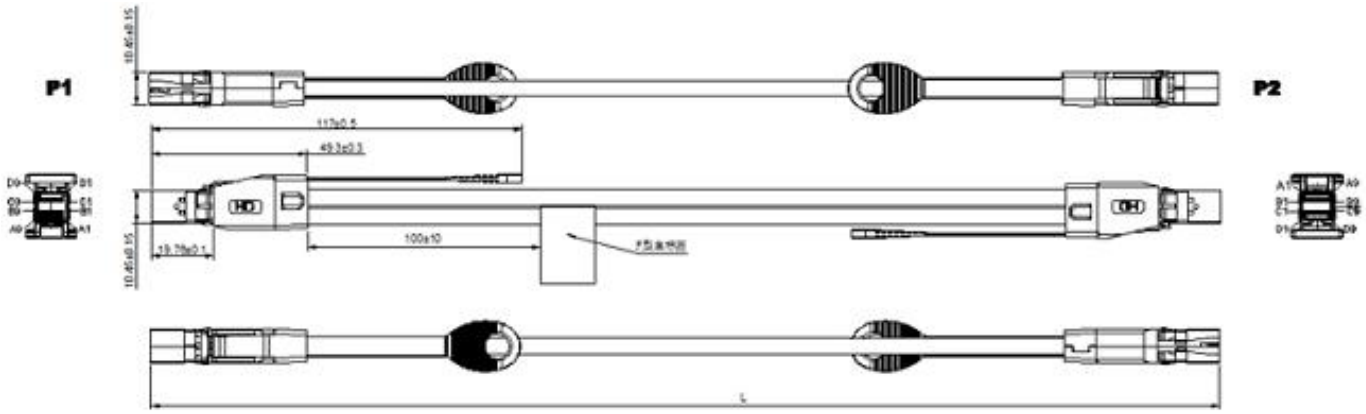
S_{DD21} is insertion loss

Mechanical Specifications

The connector is compatible with the SFF-8644 specification.

Length (m)	Cable AWG
0.5	30AWG
1	30AWG/28AWG
2	30AWG/28AWG
3	30AWG/28AWG/26AWG
4	28AWG/26AWG

Mechanical Dimensions



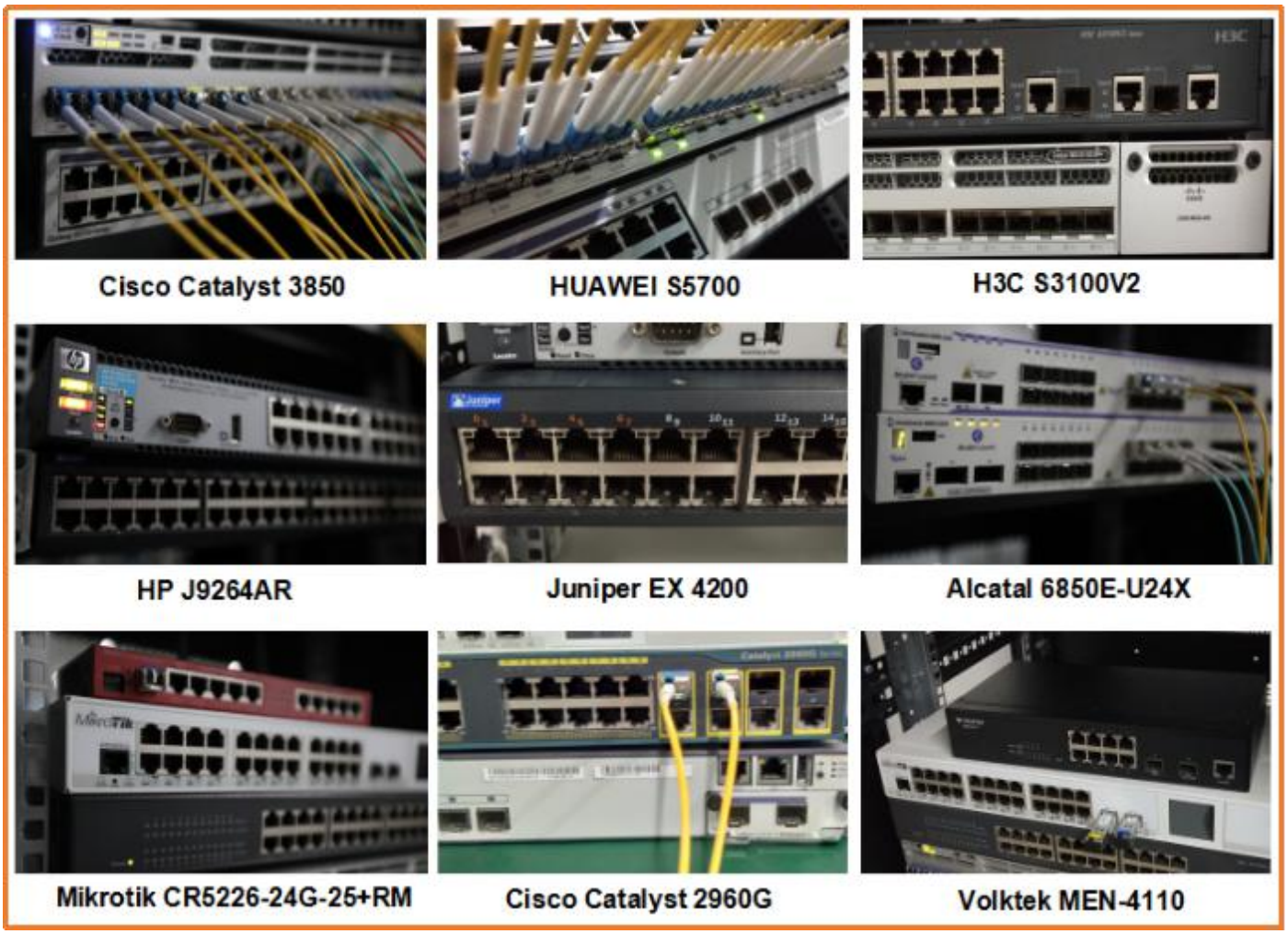
Regulatory Compliance

Feature	Test Method	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL -STD-883C Method 3015.7	Class 1(>2000 Volts)
Electromagnetic Interference(EMI)	FCC Class B	Compliant with Standards
	CENEL EC EN55022 Class B	
	CISPR22 ITE Class B	
RF Immunitx(RFI)	IEC61000-4-3	Typically Show no Measurable Effect from a 10V/m Field Swept from 80 to 1000MHz
RoHS Compliance	RoHS Directive 2011/65/EU and it's Amendment Directives 6/6	RoHS 6/6 compliant

Compatibility Test

In order to ensure the product compatibility, our products will be tested on the switch before shipment. Our modules can compatible with many mainstream brand switches, such as Cisco, Juniper, Extreme, Brocade, IBM, H3C, HP, Huawei, D-Link, Mikrotik, ZTE, TP-Link...

Our test equipment: VOLKTEK MEN-4110, HP 2530-8G, CRS226-24G-25+RM, Catalyst 2960G Series, Catalyst 3850 XS 10G SFP+, Catalyst 3750-E Series, HUAWEI S5700Series, H3C S3100V2 Series, Juniper-EX4200, etc.



Product Production Process

Quality Assurance

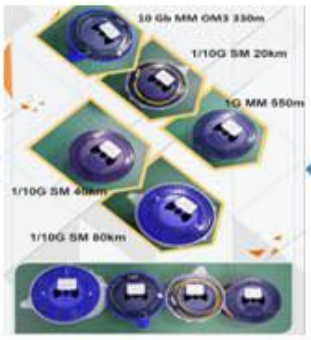
Continuous introduction of new equipment, produced by strict standards, strict quality inspection, to guarantee the high quality standard of each product.

Standardized Production Line

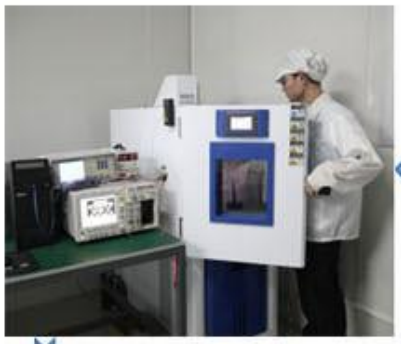
Professional Welding

Assembling

Cleaning end face



Distance Testing



Aging Testing

Product Initial Test

Switch Testing

Product Final Test

Packaging

ETU-Link provides two kinds of packaging, 10pcs/Tray and individual package.

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