

Specification

48Gbit/s Mini SAS HD

Active Optical Cable



Ordering Information

Model Name	Voltage	Category	Device type	Interface	Temperature	Distance
TMS-E1EH8-X6101	3.3V	DDMI	VCSEL*4 / PIN*4	AC / AC Coupling	0°C~+70°C	1 m
TMS-E1EH8-X6104						4 m
TMS-E1EH8-X6105						5 m
TMS-E1EH8-X6110						10 m
TMS-E1EH8-X6125						25 m

Features

- **Maximum Data Rate up to 48Gbps**
- **Link distance up to 100m over OM4 MMF**
- **4 channel 850nm VCSEL and PIN type detector**
- **Connector compliant to SFF-8644**
- **Management interface compliant to SFF-8636**
- **Hot Pluggable**
- **Single 3.3V and high speed AC-Coupled**
- **Operating Temperature range: 0°C to 70°C**
- **ROHS Compliant**

Applications

- **48G Mini SAS HD**
- **Server / Storage, Work Stations**
- **HBAs (Host Bus Adapters) Servers**
- **Storage Racks, RAIDs**

General Description

FormericaOE Mini-SAS HD active optical cable (AOC) is of high-performance with full-duplex and aggregate 48-Gbps bandwidth for SAS-3 protocol in storage applications. Compared to conventional copper cables, longer, lighter, and flexible optical cables enable the ease of complicated data-center cabling. High-quality of 850-nm VCSELs and PIN PDs are utilized in the AOC cables, with superior signal integrity and bit-error-rate performance, which enables reliable operation performance.

Function Block

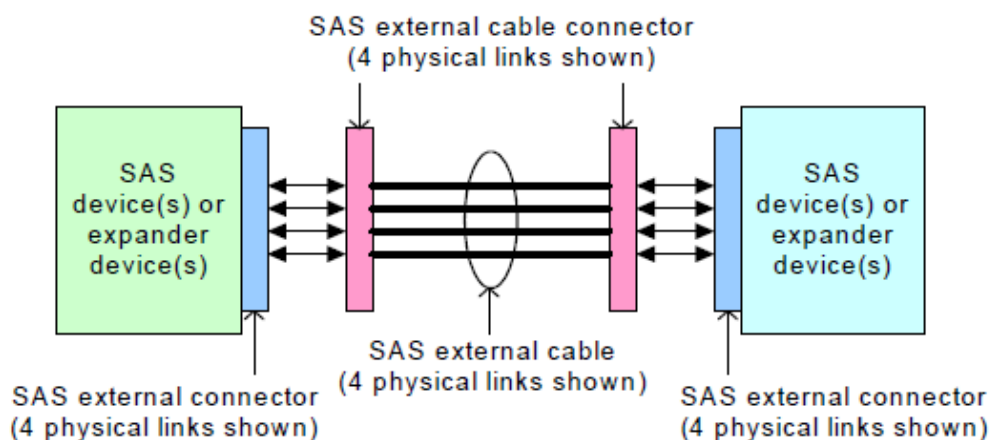


Figure - SAS external cable environment

Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Operating Case temperature	Tc	0		70	°C
Supply Voltage (Active Cable Power)	Vact	3.15	3.3	3.45	V
Current Consumption (per cable end)	Iact		300	450	mA
Data Rate per Channel			12		Gbps
Receiver Differential Impedance			100		Ohm
Receiver Common-mode Impedance			25		Ohm
Control Input Voltage High	Vih	2		Vact	V
Control Input Voltage Low	Vil	0		0.8	V
Two Wire Serial Interface Clock Rate	fsck			400	kHz

Electrical characteristics for 12 Gbps (one channel)

Parameter	Cable Input	Cable Output	Unit
Maximum peak to peak voltage (2 x Z2)	1200	1200	mV(P-P)
Minimum eye opening (2 x Z1)	200	190	mV(P-P)
Maximum half of TJ (X1)	0.175	0.3	UI
Maximum RJ	0.15	0.33	UI
Center of bit time (X2)	0.5	0.5	UI

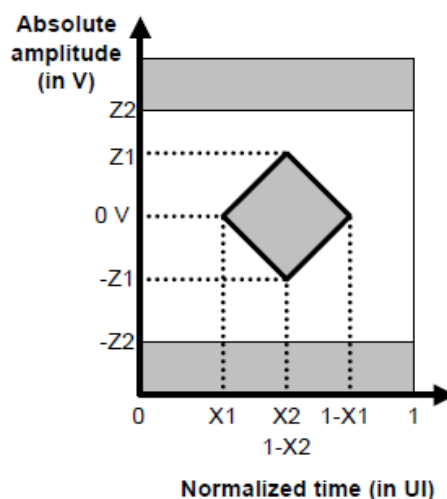
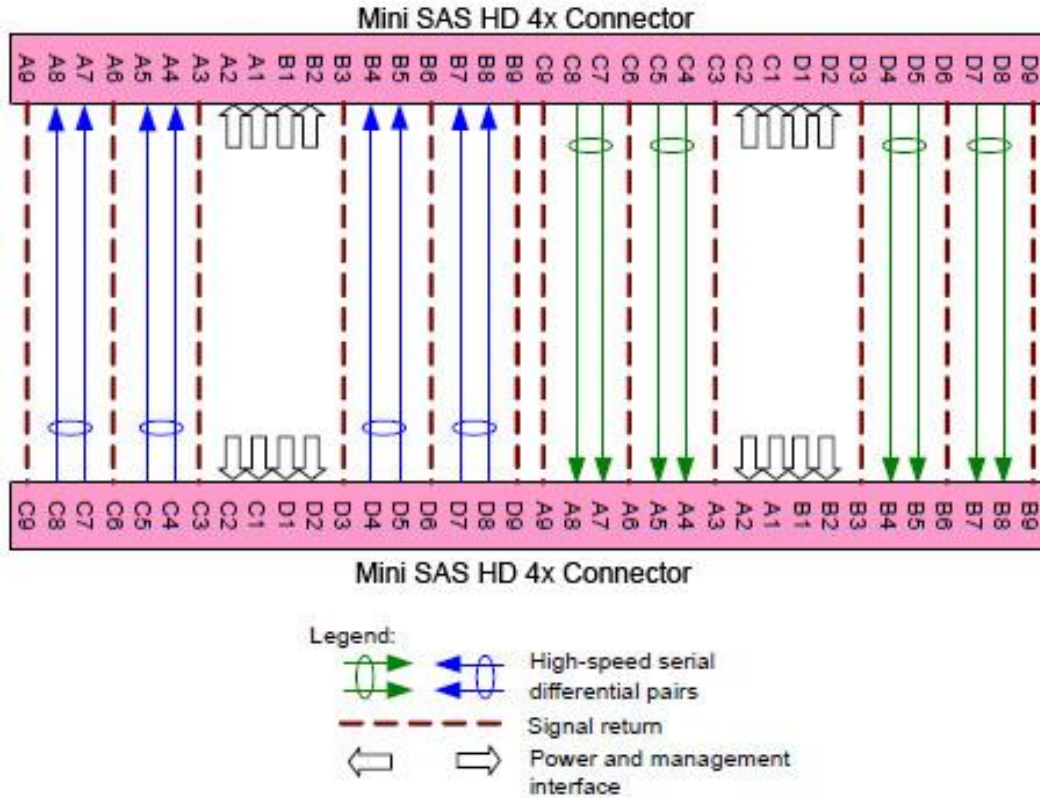
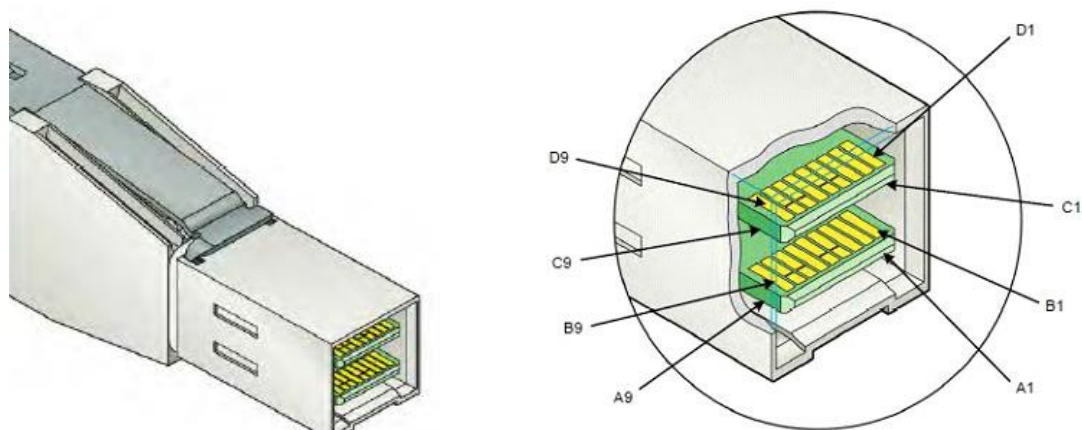


Figure - Active cable eye mask for 12 Gbps

Typical Application



Pin Definition



Pin Descriptions

Pin	Pin usage based on number of physical links supported by the cable assembly ^a				Mating level ^b
	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	A2	A2	A2	A2	Second
Reserved	A1	A1	A1	A1	
ModPrsL	B2	B2	B2	B2	
Vact	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	
Tx 1-	N/C	C5	C5	C5	
Tx 1+	N/C	C4	C4	C4	
SDA	C2	C2	C2	C2	Second
SDL	C1	C1	C1	C1	
Vman	D2	D2	D2	D2	
Vact	D1	D1	D1	D1	
Tx 2-	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

a. N/C = not connected
 b. The mating level indicates the physical dimension of the contact (see SFF-8644).

Content in 2-Wire Address A0H (Page 00)

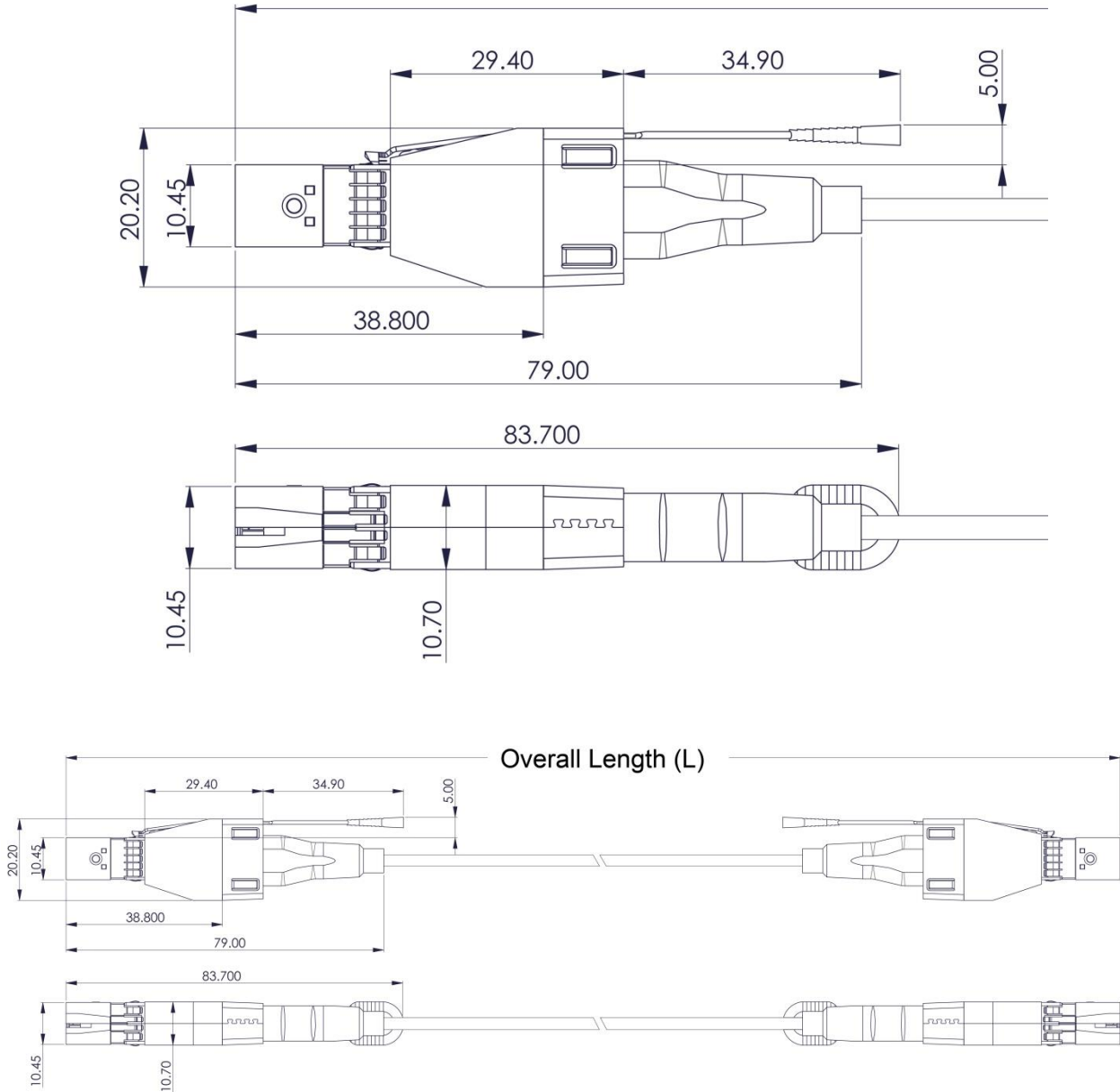
Address	HEX	Name of Field	Description
128	0F	Identifier	Shielded Mini Multilane HD 4X Power Class 1 Module (1.5 W max. Power consumption)
129	00	Extended Identifier	No CLEI code present in Page 02h, No CDR in TX and RX
130	23	Connector type	No separable connector
131	00	10/40G Ethernet Compliance Code	Not compliant
132	00	SONET Compliance Codes	Not compliant
133	70	SAS/SATA compliance codes	SAS 12.0 / 6.0 / 3.0 Gbps
134	00	Gigabit Ethernet Compliant codes	Not compliant
135	00	Fiber Channel link length	Not compliant
136	00	Fiber Channel transmitter technology	Not compliant
137	00	Fiber Channel transmission media	Not compliant
138	00	Fiber Channel speed	Not compliant
139	00	Encoding codes	Unspecified
140	78	Nominal Bit Rate (units of 100Mbps)	12000 Mbps
141	00	Extended RateSelect Compliance	QSFP+ Rate Select Version 1
142	00	Length (Standard SM Fibre)	Active optical cable
143	00	Length (OM3)	Active optical cable
144	00	Length (OM2)	Active optical cable
145	00	Length (OM1)	Active optical cable
146	(A)	Length (OM4)	Active optical cable
147	00	Device Technology	850 nm VCSEL Uncooled transmitter device Pin detector
148 ~ 163	46,4F,52,4D,45,52,49,43,41,4F,45,20,20,20,20,20	Vendor Name	FORMERICA OE
164	00	Extended Module Codes	Not compliant
165 ~ 167	00,00,00	Vendor OUI	Unspecified
168 ~ 183	54,4D,53,2D,45,31,45,48,38,2D,58,36,31,(B),(C),20	Part Number	TMS-E1EH8-X61??
184 ~ 185	30,30	Vendor Revision number	00
186 ~ 187	42,04	Laser Wavelength	845nm
188 ~ 189	0B,B8	Wavelength Tolerance	±15nm
190	46	Maximum Case Temperature	70°C
191		CC_BASE	Check sum of byte 128 ~ 190
192 ~ 195	00,00,00,80	Options	Memory page 02 provided
196 ~ 211	Serial Number	Serial Number	
212 ~ 219	yy/mm/dd	Date Code	
220	08	Diagnostic Monitoring Type	Received power measurements type: Average Power
221	00	Enhanced Options	
222	00	Reserved	
223		CC_EXT	Check sum of byte 192 ~ 222
224 ~ 255		Vendor specific	

Model Name	Length	(A)	(B)	(C)
TMS-E1EH8-X6101	1 M	01	30	31
TMS-E1EH8-X6104	4 M	02	30	34
TMS-E1EH8-X6105	5 M	03	30	35
TMS-E1EH8-X6110	10 M	05	31	30
TMS-E1EH8-X6125	25 M	0D	32	35
TMS-E1EH8-X6150	50 M	19	35	30
TMS-E1EH8-X61A0	100M	32	41	30

Content in 2-Wire Address A0H (Page 03)

Address	Bytes	Name	Hex	Real Value
128 ~ 129	2	Temp High Alarm	4B00	75°C
130 ~ 131	2	Temp Low Alarm	FB00	-5°C
132 ~ 133	2	Temp High Warning	4600	70°C
134 ~ 135	2	Temp Low Warning	0000	0°C
136 ~ 143	8	Reserved	00	-
144 ~ 145	2	Voltage High Alarm	88B8	3.50V
146 ~ 147	2	Voltage Low Alarm	7918	3.10V
148 ~ 149	2	Voltage High Warning	86C4	3.45V
150 ~ 151	2	Voltage Low Warning	7B0C	3.15V
152 ~ 159	8	Reserved	00	-
160 ~ 175	16	Vendor Specific	00	-
176 ~ 177	2	RX Power High Alarm	8A99	5.5 dBm
178 ~ 179	2	RX Power Low Alarm	0232	-12.5 dBm
180 ~ 181	2	RX Power High Warning	7B87	5.0 dBm
182 ~ 183	2	RX Power Low Warning	02C4	-11.5 dBm
184 ~ 185	2	Bias High Alarm	2134	17 mA
186 ~ 187	2	Bias Low Alarm	01F4	2 mA
188 ~ 189	2	Bias High Warning	1D4C	15 mA
190 ~ 191	2	Bias Low Warning	03E8	1 mA
192 ~ 199	8	Reserved	00	-
200 ~ 207	8	Reserved	00	-
208 ~ 223	16	Vendor Specific	00	-

Mechanical Outlines (Unit: mm)



Model Name	L (meters)
TMS-E1EH8-X6101	1 ± 0.02
TMS-E1EH8-X6104	4 ± 0.05
TMS-E1EH8-X6105	5 ± 0.05
TMS-E1EH8-X6110	10 ± 0.05
TMS-E1EH8-X6125	25 ± 0.10
TMS-E1EH8-X6150	50 ± 0.10
TMS-E1EH8-X61A0	100 ± 0.20