Preliminary Technical Data (v0.4, July, 1999)

HITACHI

MDS/R4212A

12-channel Optical Interconnect Modules

Preliminary Product Disclaimer

This preliminary data sheet is provided to assist you in the evaluation of functional samples of the products which are under development and for which reliability testing has not been completed. Hitachi, Ltd. reserves the right to change prices, features, functions, specifications, capabilities and release schedule, until it releases these products for general sales.

FEATURES

- **12-channel parallel transmission from DC to 800 Mbit/s per channel**
- **Transmission distance up to 50 m**
- **Compact size: 3.9 cm^3, and low power consumption: 300 mW/ch**
- **Single 3.3 V power supply**
- **MPO (Multi-path Push-On) / MT (Mechanical Transfer) optical connector**
- **Wide temperature range: Tc= 0 to 80°C**
- **Reliable hermetically-sealed active components**

DESCRIPTION

General

Hitachi's 12-channel parallel optical interconnects modules MDS/R4212A offer an attractive solution over the electrical interconnection bottleneck. The MDS/R4212A modules are used in applications that require very high data throughput such as high-speed computers, high-capacity communication systems, and large-capacity data-acquisition systems.

The MDS/R4212A modules provide synchronous 11 data channels and single clock channel. Each data channel can handle from DC up to 800 Mbit/s data stream. Both the transmitter and receiver include latches to adjust the 11 data slots, which release from the optical transmission skew.

The MDS/R4212A modules are fully integrated 12-channel optical interconnect modules. The MDS4212A transmitter consists of a monolithically integrated 12-channel LD (Laser Diode) array and driver array IC array. The MDR4212A receiver consists of a monolithically integrated 12-channel PD (PhotoDiode) array and receiver array IC. They are incorporated in hermetically sealed compact packages. The power consumption is 300 mW per channel.

The MDS/R4212A modules require a single 3.3-V power supply. The MDS/R4212A modules have widely used MPO or MT optical connectors.

Block Diagram

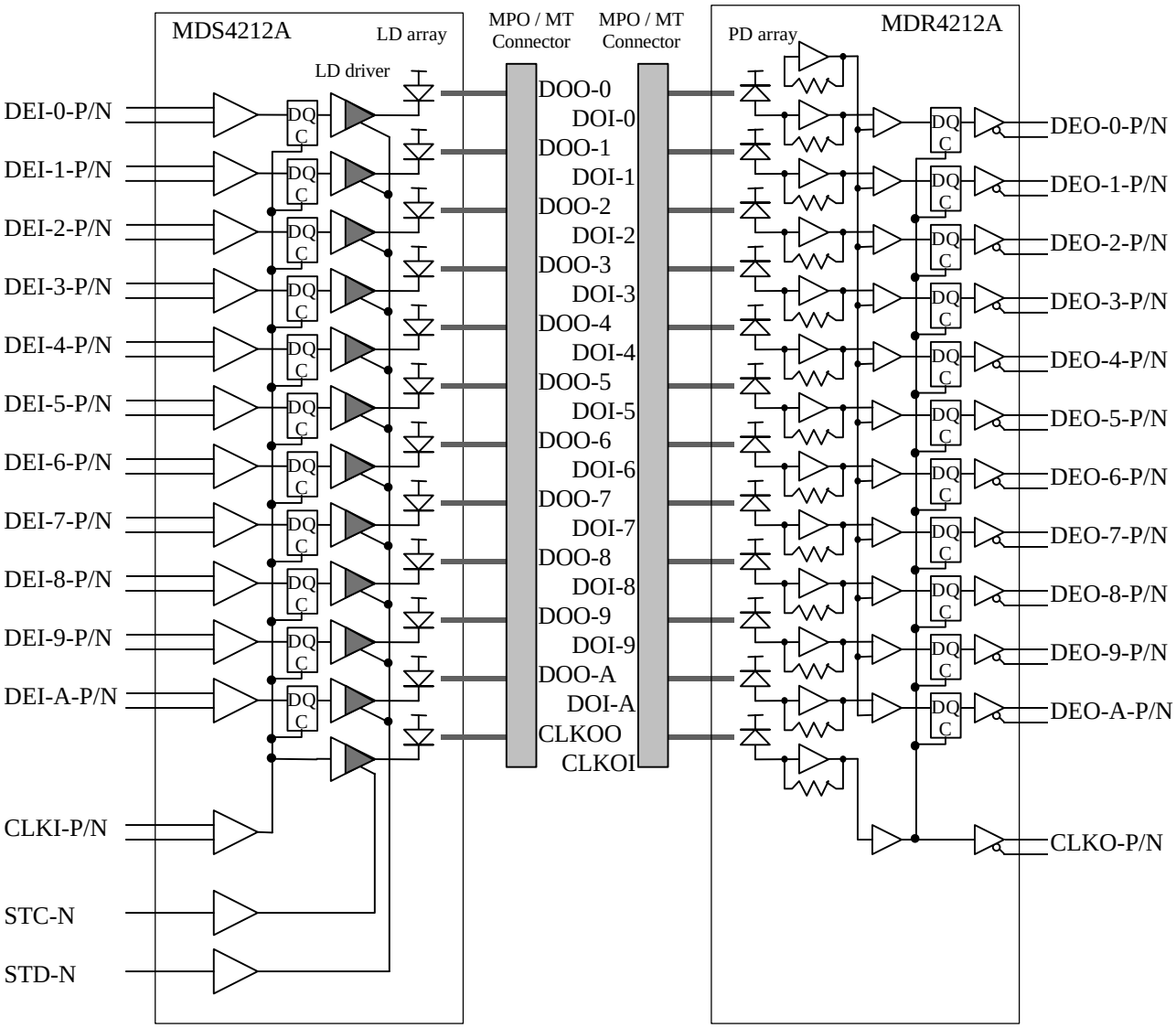


Figure 1. Block diagram of MDS/R4212A

Functional Description

(1) Latch (MDS4212A)

No.	DEI-[0:A]	CLKI-p	DOO-[0:A]	Remarks
1	H	⎍	H	Emitting
2	L	⎍	L	Extinction

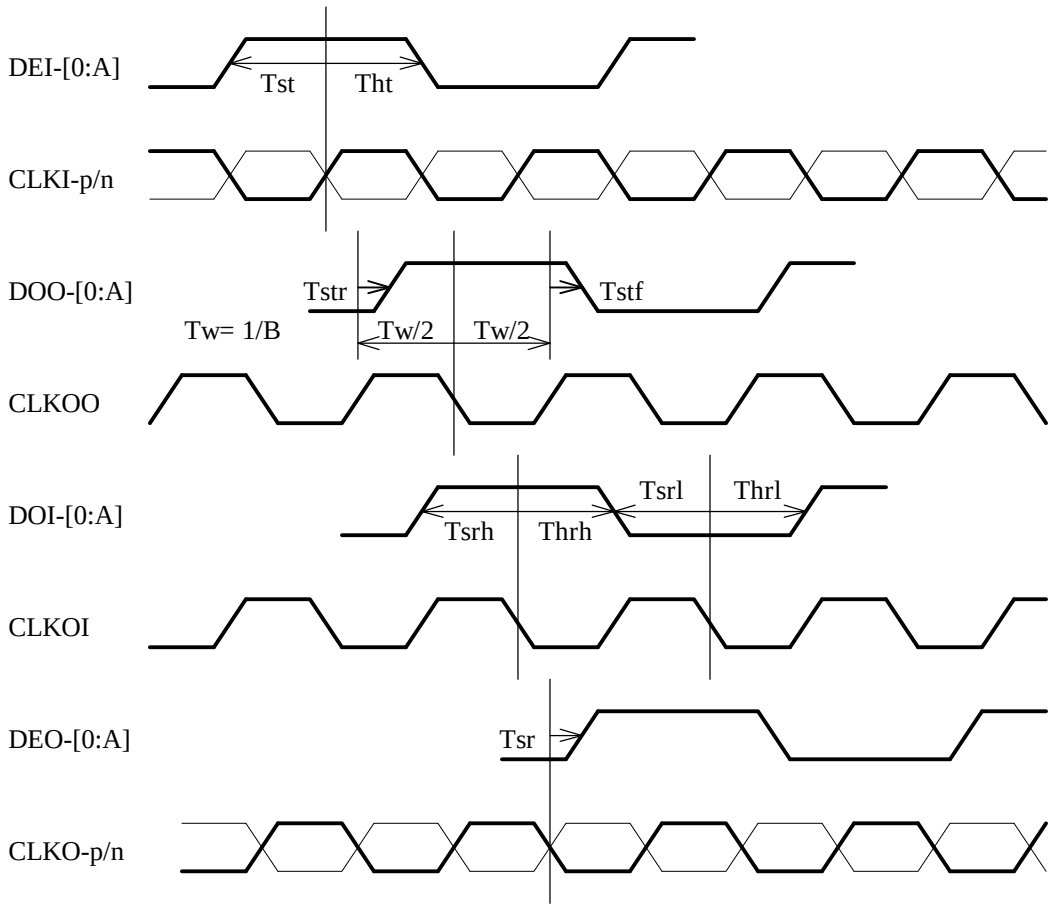
(2) Latch (MDR4212A)

No.	DOOI-[0:A]	CLKOI	DEO-[0:A]	Remarks
1	H	⎏	H	
2	L	⎏	L	

(3) Shut Down (MDS4212A)

No.	STD-N	STC-N	Function	Remarks
1	L	-	DOO-[0:A] Shut down	
2	-	L	CLKOO Shut down	
3	H	H	(Normal Operation)	

(4) Timing Chart



Recommended Circuit

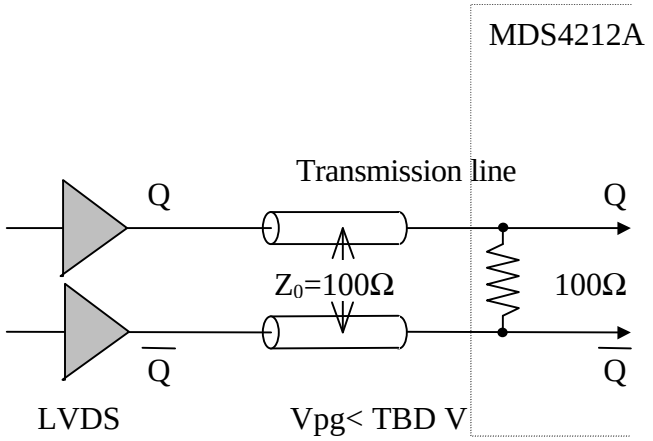
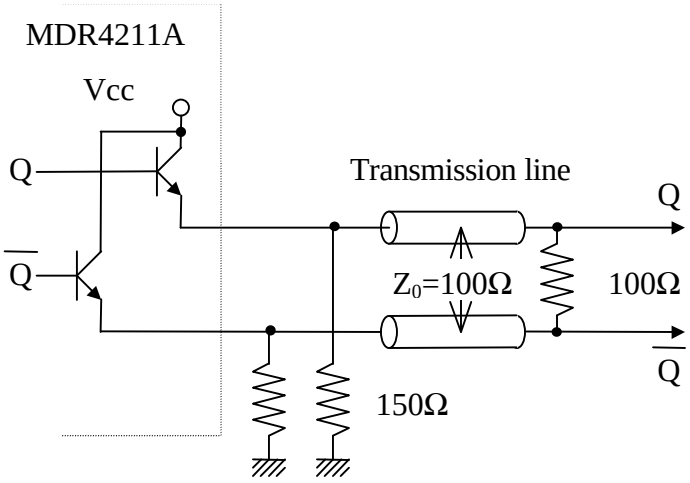
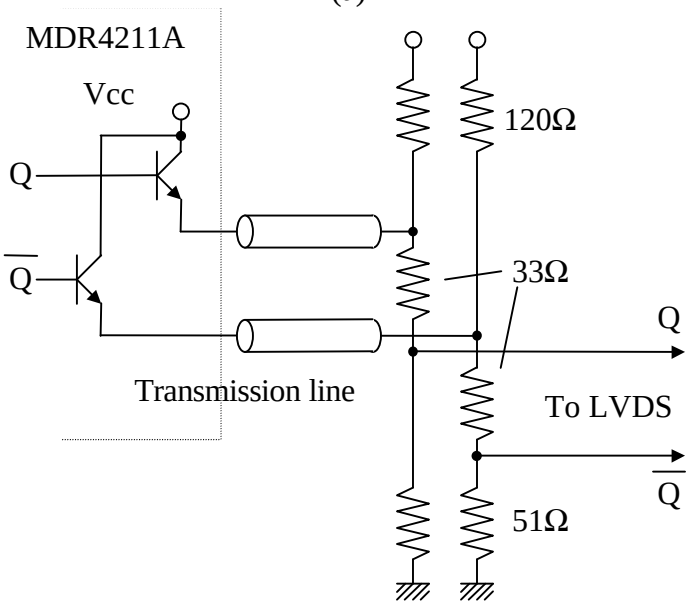


Figure 2. Recommended Termination Circuit (MDS4212A)



(a)



(b)

Figure 3. Recommended Termination Circuit (MDR4212A) for (a) PECL and (b) LVDS

PERFORMANCE SPECIFICATIONS

Absolute Maximum Ratings

Table 1. Absolute Maximum Ratings

No.	Parameter	Symbol	Min	Max	Unit	Remarks
1	Supply Voltage	Vcc	Vee - 0.3	Vee + 4.5	V	
2	Input Voltage (High speed signal: DEI, CLKI)	Vihs	Vee - 0.5	Vee + 2.0	V	100Ω termination included
3	Input Voltage Difference (High speed signal: DEI, CLKI)	Vihsd	-	0.6	V	100Ω termination included
4	Input Voltage (Control signal)	Vics	Vee - 0.5	Vcc	V	
5	Output Current (High Speed Signal: DEO, CLKO)	Iso	-	26	mA	
6	Input Optical Power	Pi		0	dBm	
7	Operating Case Temperature	Tc	0	80	°C	
8	Operating Connector Temperature	Tcn	0	70	°C	
9	Storage Temperature	Tstr	-20	80	°C	
10	Fiber Array Tensile Strength	Lpg	5.9		N	
11	Fiber Array Bend Radius	Rpg	30		mm	

Operating Environment

The electrical and optical characteristics below are defined under this operating environment unless otherwise noted.

Table 2. Operating Environment

No.	Parameter	Symbol	Min	Typ	Max	Unit	Remarks
1	Power Supply Voltage	Vcc	3.0	3.3	3.6	V	
2	Operating Case Temperature	Tc	0		80	°C	

Electrical Characteristics

Table 3. Power Consumption

No.	Parameter	Symbol	Min	Typ	Max	Unit	Remarks
1	Tx Power Consumption	Pds			1.9	W	
2	Rx Power Consumption	Pdr			1.7	W	

Table 4. Electrical AC Characteristics

No.	Parameter	Symbol	Min	Typ	Max	Unit	Remarks
1	Data rate	B	DC	-	800 M	bit/s	synchronous
2	Clock Frequency	Fc	TBD	-	800 M	Hz	
3	Tx Input Set-up Time	Tst	-	-	0.4	ns	
4	Tx Input Hold Time	Tht	-	-	0.4	ns	
5	Rx Output Skew	Tsr	-0.25	-	0.25	ns	
6	Rx Output Rise/Fall Time	Trr/Tfr	-	-	0.3	ns	20 – 80%
7	Tx Input Clock Duty	Dci	45	-	55	%	
8	Clock Duty Degradation	dDco	-10	-	10	%	

Table 5. Interface for data and clock channels

No.	Parameter	Symbol	Min	Typ	Max	Unit	Remarks
1	High Level Input Voltage	VIHs	1.175		1.90	V	LVDS H out
2	Low Level Input Voltage	VILs	0.925		1.65	V	LVDS L out
3	Input Amplitude	VIAs	0.25		0.6	V	LVDS out
4	Offset Voltage	Voffs	1.125		1.775	V	LVDS out
5	High Level Output Voltage (Tc=0°C)	VIHs	2.230		2.460	V	
6	Low Level Output Voltage (Tc=0°C)	VILs	1.350		1.670	V	
7	High Level Output Voltage (Tc=20°C)	VIHs	2.270		2.490	V	
8	Low Level Output Voltage (Tc=20°C)	VILs	1.350		1.670	V	
9	High Level Output Voltage (Tc=80°C)	VIHs	2.340		2.580	V	
10	Low Level Output Voltage (Tc=80°C)	VILs	1.350		1.705	V	

Table 6. LV-TTL Interface for control signals

No.	Parameter	Symbol	Min	Typ	Max	Unit	Remarks
1	High Level Input Voltage	VIH	2.0			V	
2	Low Level Input Voltage	VIL			0.8	V	
3	High Level Output Voltage	VIH	2.0			V	
4	Low Level Output Voltage	VIL			0.8	V	

Optical Characteristics

Table 7. Optical Interface

No.	Parameter	Symbol	Min	Typ	Max	Unit	Remarks
1	Wavelength	λ_T	-	1310	-	nm	
2	Fiber		-	SMF	-30		

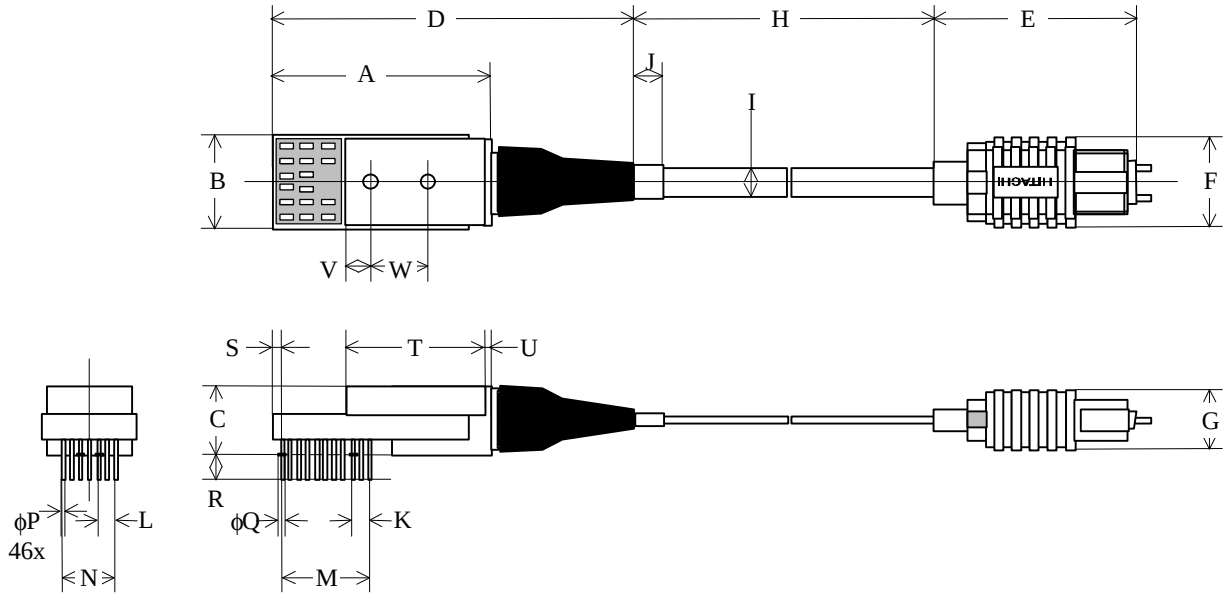
Table 8. Optical DC Characteristics

No.	Parameter	Symbol	Min	Typ	Max	Unit	Remarks
1	Tx High Level Output Power	P_{OH}	-7.8	-	-3	dBm	
2	Tx Low Level Output Power	P_{OL}	-	-	-30	dBm	
3	Tx Shut-down Output Power	P_{SH}	-	-	-30	dBm	Data channls
4	Rx High Level Input Power	P_{IH}	-12.6	-	-3	dBm	
5	Rx Low Level Input Power	P_{IL}	-	-	-20	dBm	

Table 9. Optical Skew Characteristics

No.	Parameter	Symbol	Min	Typ	Max	Unit	Remarks
1	Tx Skew at rising edge	Tstr	0.2	-	0.2	ns	
2	Tx Skew at falling edge	Tstf	-0.1	-	0.1	ns	
3	Rx Set-up Time for H	Tsrh	-	-	0.3	ns	
4	Rx Set-up Time for L	Tsrl	-	-	0.3	ns	
5	Rx Hold Time for L	Thrl	-	-	0.3	ns	
6	Rx Hold Time for H	Thrh	-	-	0.3	ns	

Package Dimensions



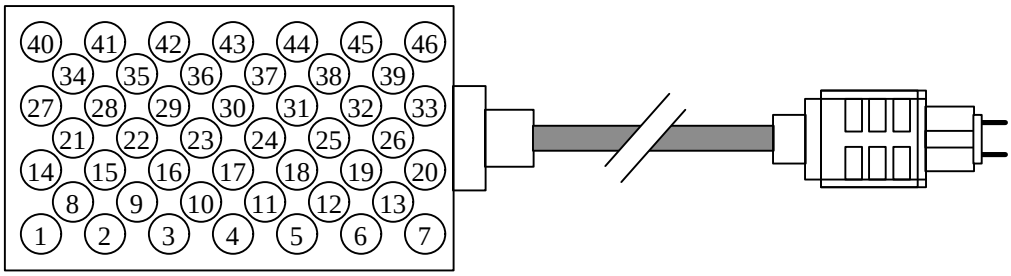
DIM.	MILLIMETERS			INCHES		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	TBD		TBD	TBD		TBD
B			13.5			0.532
C			TBD			TBD
D			50			1.969
E			33			1.300
F			12.59			0.496
G			7.7			0.304
H	TBD		TBD	TBD		TBD
I			4.7			0.185
J			5			0.197
K		2.54			0.1	

DIM.	MILLIMETERS			INCHES		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
L		2.54			0.100	
M		15.24			0.600	
N		7.62			0.300	
ϕP	0.4		0.5	0.016		0.020
ϕQ	0.8		1.2	0.031		0.047
R	2.6		3.4	0.102		0.134
S	0.97		1.57	0.038		0.062
T		TBD			TBD	
U		1			0.039	
V		3.5			0.138	
W	7.8		8.2	0.307		0.323

Pin Configuration

Table 10. Pin configuration (MDS4212A)

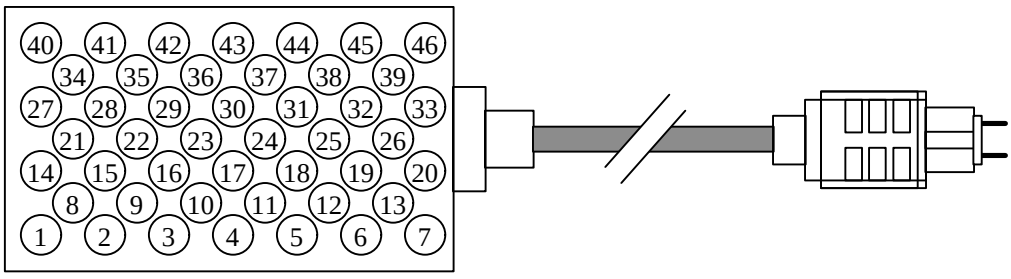
Pin	Symbol	Description	Pin	Symbol	Description
1	STD-N	Data channel shut down	24	Vee	GND
2	DEI-10-P	DATA-10-P input	25	DEI-3-P	DATA-3-P input
3	Vcc	+3.3V	26	DEI-4-P	DATA-4-P input
4	DEI-9-P	DATA-9-P input	27	STC-N	Clock channel shut down
5	Vee	GND	28	DEI-1-P	DATA-1-P input
6	Vcc	+3.3V	29	Vcc	+3.3V
7	PPD-P	(Normal operation.: L)	30	DEI-2-P	DATA-2-P input
8	Vee	GND	31	DEI-3-N	DATA-3-N input
9	DEI-10-N	DATA-10-N input	32	Vcc	+3.3V
10	DEI-9-N	DATA-9-N input	33	DEI-4-N	DATA-4-N input
11	Vee	GND	34	CN2-P	(Normal operation.: L)
12	DEI-8-P	DATA-8-P input	35	DEI-1-N	DATA-1-N input
13	DEI-7-P	DATA-7-P input	36	DEI-2-N	DATA-2-N input
14	-	N.C.	37	Vee	GND
15	DEI-6-P	DATA-6-P input	38	CLK-P	CLK-P input
16	Vcc	+3.3V	39	DEI-0-P	DATA-0-P input
17	DEI-5-P	DATA-5-P input	40	FFD-P	(Normal operation.: L)
18	DEI-8-N	DATA-8-N input	41	CO2-P	(Normal operation.: L)
19	Vcc	+3.3V	42	Vcc	+3.3V
20	DEI-7-N	DATA-7-N input	43	Vee	GND
21	Vee	GND	44	CLK-N	CLK-N input
22	DEI-6-N	DATA-6-N input	45	Vcc	+3.3V
23	DEI-5-N	DATA-5-N input	46	DEI-0-N	DATA-0-N input



Top view

Table 11. Pin configuration (MDR4212A)

Pin	Symbol	Description	Pin	Symbol	Description
1	Vcc	+3.3V	24	Vee	GND
2	DEO-10-P	DEO-10-P output	25	DEO-3-P	DATA-3-P output
3	Vcc	+3.3V	26	DEO-4-P	DATA-4-P output
4	DEO-9-P	DATA-9-P output	27	ATC-N	(Normal operation.: L)
5	Vee	GND	28	DEO-1-P	DATA-1-P output
6	Vcc	+3.3V	29	Vcc	+3.3V
7	LOS-P	Loss of signal output	30	DEO-2-P	DATA-2-P output
8	Vcc	+3.3V	31	DEO-3-N	DATA-3-N output
9	DEO-10-N	DATA-10-N output	32	Vcc	+3.3V
10	DEO-9-N	DATA-9-N output	33	DEO-4-N	DATA-4-N output
11	Vee	GND	34	CN2-P	(Normal operation.: L)
12	DEO-8-P	DATA-8-P output	35	DEO-1-N	DATA-1-N output
13	DEO-7-P	DATA-7-P output	36	DEO-2-N	DATA-2-N output
14	Vee	GND	37	Vee	GND
15	DEO-6-P	DATA-6-P output	38	CLK-P	CLK-P output
16	Vcc	+3.3V	39	DEO-0-P	DATA-0-P output
17	DEO-5-P	DATA-5-P output	40	FFD-P	(Normal operation.: L)
18	DEO-8-N	DATA-8-N output	41	CO2-P	(Normal operation.: L)
19	Vcc	+3.3V	42	Vcc	+3.3V
20	DEO-7-N	DATA-7-N output	43	Vee	GND
21	Vee	GND	44	CLK-N	CLK-N output
22	DEO-6-N	DATA-6-N output	45	Vcc	+3.3V
23	DEO-5-N	DATA-5-N output	46	DEO-0-N	DATA-0-N output



Top view

Qualification

The following qualification test in Table 12 is scheduled.

Table 12. Plan for Qualification Test

No.	Test Item	Test Condition	MDS4212A		MDR4212A	
			Criteria	Size	Criteria	Size
1	Mechanical shock	MIL-STD-883C Method 2002 15000 m/s^2, 0.5 ms, 5 times/axis, 6 axes		11		11
2	Vibration	MIL-STD-883C Method 2007 196 m/s^2, 20 to 2000 Hz, 4 min/cycle, 4 cycle/axis, 3 axes		11		11
3	Fiber pull	1 kg, 3 times		11		11
4	Temperature cycling	MIL-STD-883C Method 1010 ΔT=100°C, 100-cycle		11		11
5	High temperature operation	Ta= 70°C, 1 m/s Air flow, 2000h		11		11
6	High temperature storage	85°C, 2000h		11		11
7	High relative humidity storage	MIL-STD-883C Method 103 95%, 40°C, 1344h		11		11
8	Electrostatic discharge sensitivity	MIL-STD-883C Method 3015.7 Single pins: 1000 V, power supply and control pins: 2000 V	All functional	6	All functional	6

USER INFORMATION

Handling Precautions

CAUTION: Take proper electrostatic-discharge (ESD) precautions while handling these devices. These devices are sensitive to ESD damage.

Laser Safety

This product complies with IEC 60825-1 Class 1.
Because of size constraints, laser safety labeling is not affixed to the module but attached to the outside of the shipping carton.

Ordering Information

Table 13 Ordering Information

Device Name	Description			
	Device	Channel Speed	Channel	Latches
MDS4212A	12-ch Tx	DC - 800 Mbit/s	11 Data + CLK	Included
MDR4212A	12-ch Rx	DC - 800 Mbit/s	11 Data + CLK	Included