



CL-SFP-MD40-XX/4,5 DD
4,5G DWDM SFP Optical Transceiver Module
Hot Pluggable, Duplex LC, +3.3V, 100GHz, DWDM EML, Single mode
RoHS 6 compliant



Features

- Up to 4.25Gb/s bit rates
- Hot-Pluggable
- Duplex LC connector
- 100GHz ITU Grid, C Band
- DWDM EML transmitter
- SMF links up to 40km
- 2-wire interface for management specifications compliant with SFF 8472 digital diagnostic monitoring interface
- Power Supply :+3.3V
- Power consumption<1.5W
- Temperature Range: -5~70°C
- RoHS compliant

Applications

- Ethernet Applications FE/GE
- Multi-rate 1×FC /2×FC /4×FC
- DWDM Networks
- Other Optical Networks

PART NUMBER	Monitor	INPUT/OUTPUT	SIGNAL DETECT	TEMPERATURE
CL-SFP-MD40-XX/4,5 DD	X	AC/AC	TTL	-5°C to 70 °C
CL-SFP-MD40-XX/4,5 DDI	X	AC/AC	TTL	-40°C to 85 °C



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Description

Carelink transceivers are designed for use in Fibre Channel links up to 40 km at 4.25 Gb/s data rate. The high performance 100GHz ITU Grid DWDM EML transmitter and PIN receiver provide superior performance for 4x Fibre Channel applications at up to 40km links.

The SFP Module compliant with SFP MSA and FC-PI-4 Rev. 8.00. Digital diagnostics functions are available via a 2-wire serial interface, as specified in SFF-8472.

The fully SFP compliant form factor provides hot pluggability, easy optical port upgrades and low EMI emission.

Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit
Storage Temperature	T_s	-40		+85	°C
Supply Voltage	$V_{CC,T,R}$	-0.5		4	V
Relative Humidity	RH	0		85	%
Case Operating Temperature	T_{op}	-5		70	°C

Recommended Operating Environment:

Parameter	Symbol	Min.	Typical	Max.	Unit
Case operating Temperature	T_c	-5		+70	°C
Supply Voltage	$V_{CC,T,R}$	3.0		3.6	V
Power Supply Rejection		100			mV _{P-P}



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Electrical Characteristics ($T_{OP} = -5$ to 70 °C, $V_{CC} = 3.135$ to 3.465 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Supply Voltage	Vcc	3.0		3.6	V	
Supply Current	Icc		200	300	mA	
Transmitter						
Input differential impedance	Rin		100		Ω	1
Single ended data input swing	Vin,pp	250		1200	mV	
Transmit Disable Voltage	VD	2		Vcc	V	
Transmit Enable Voltage	VEN	Vee		Vee+ 0.8	V	2
Receiver						
Single ended data output swing	Vout,pp	250	400	800	mV	3
Data output rise/fall time ≤ 2.125 Gb/s	Tr/f			175	ps	4
Data output rise/fall time =4.25 Gb/s	Tr/f			120	ps	4
LOS Fault	VLOS fault	Vcc-0.5		VccHOST	V	5
LOS Normal	VLOS norm	Vee		Vee+0.5	V	5
Power Supply Rejection	PSR	100			mVpp	6
Deterministic Jitter Contribution ≤ 2.125 Gb/s	RX Δ DJ			51.7	ps	7,8
Deterministic Jitter Contribution =4.25 Gb/s	RX Δ DJ			25.9	ps	8,9
Total Jitter Contribution ≤ 2.125 Gb/s	RX Δ TJ			122.4	ps	8
Total Jitter Contribution =4.25 Gb/s	RX Δ TJ			61.2	ps	9

Notes:

1. AC coupled.
2. Or open circuit.
3. Into 100 ohm differential termination.
4. 20 – 80 %.
5. LOS is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
6. All transceiver specifications are compliant with a power supply sinusoidal modulation of 20 Hz to 1.5 MHz up to specified value applied through the power supply filtering network shown on page 23 of the Small Form-factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), September 14, 2000. The Power Supply Rejection applies for a supply voltage range of 3.1 to 3.6 V.
7. Measured with DJ-free data input signal. In actual application, output DJ will be the sum of input DJ and DJ Δ .
8. As measured at 0.022 mW OMA.
9. As measured at 0.048 mW OMA.



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Optical Characteristics (TOP = -5 to 70°C, VCC = 3.135 to 3.465 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Transmitter						
Output Opt. Power	POUT	0		+5	dBm	1
Optical Wavelength-End Of Life	λ_e	$\lambda-100$	λ	$\lambda+100$	pm	
Optical Wavelength-Beginning Of Life	λ_b	$\lambda-25$	λ	$\lambda+25$	pm	
Optical Modulation Amplitude =4.25 Gb/s	OMA	190			μ W	2,3
Optical Modulation Amplitude \leq 2.125 Gb/s	OMA	174			μ W	2,3
Optical Rise/Fall Time =4.25 Gb/s	tr/ tf			105	ps	4
Optical Rise/Fall Time \leq 2.125 Gb/s	tr/ tf			160	ps	5
Relative Intensity Noise	RIN			-118	dB/Hz	
Deterministic Jitter Contribution \leq 2.125 Gb/s	TX Δ DJ			59.8	ps	6
Deterministic Jitter Contribution =4.25 Gb/s	TX Δ DJ			28.2	ps	6
Total Jitter Contribution \leq 2.125 Gb/s	TX Δ TJ			119	ps	
Total Jitter Contribution = 4.25 Gb/s	TX Δ TJ			59.8	ps	
Extinction Ratio = 1.25 Gb/s	ER	8.2			dB	7
Receiver						
Receiver Sensitivity \leq 1.0625 Gb/s	RxSEN			-23	dBm	8
Receiver Sensitivity = 2.125 Gb/s	RxSEN			-21	dBm	8
Receiver Sensitivity = 4.25 Gb/s	RxSEN			-18	dBm	8
Overload	RxMAX			0	dBm	
Receiver Elec. 3 dB cutoff frequency				1500	MHz	9



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Receiver Elec. 3 dB cutoff frequency				2500	MHz	10
Optical Center Wavelength	λ_c	1260		1620	nm	
Optical Return Loss		12			dB	
LOS De-Assert	LOSD			-19	dBm	@4xFC
LOS Assert	LOSA	-30			dBm	@4xFC
LOS Hysteresis		0.5			dB	
General Specifications						
Data Rate	BR	100		4250	Mb/s	11
Bit Error Rate	BER			10^{-12}		12
Max. Supported Link Length on 9/125 μ m SMF@ 4 \times Fibre Channel	LMAX1			40	km	13
Max. Supported Link Length on 9/125 μ m SMF@ 2 \times Fibre Channel	LMAX2			50	km	13
Max. Supported Link Length on 9/125 μ m SMF@ \leq 1.0625 Gb/s	LMAX3			50	km	13

Notes:

- Class 1 Laser Safety per FDA/CDRH and EN (IEC) 60825 regulations.
- Also specified to meet curves in FC-PI-2 10.0 Figures 18, 19, and 21, which allow trade-off between wavelength, spectral width and OMA. Rate selectable part is specified to meet IEEE Draft P802.3ah /D2.0 Figure 59-3.
- Equivalent extinction ratio specification for Fibre Channel. Allows smaller ER at higher average power.
- Unfiltered, 20-80%.
- Unfiltered, 20-80%.
- Measured with DJ-free data input signal. In actual application, output DJ will be the sum of input DJ and DJ. Δ .
- Applicable for Rate Selectable version only in low bandwidth mode.
- Measured with conformance signals defined in FC-PI-2 10.0 specifications. Measured with PRBS 2⁻¹ at 10⁻¹² BER.
- Rate Selectable version in low bandwidth mode.
- Rate Selectable version in high bandwidth mode.
- 1x/2x/4x Fibre Channel compliant.
- Tested with a PRBS 2⁻¹ test pattern.
- Distances are indicative only. Please refer to the Optical Specifications in Section IV to calculate a more

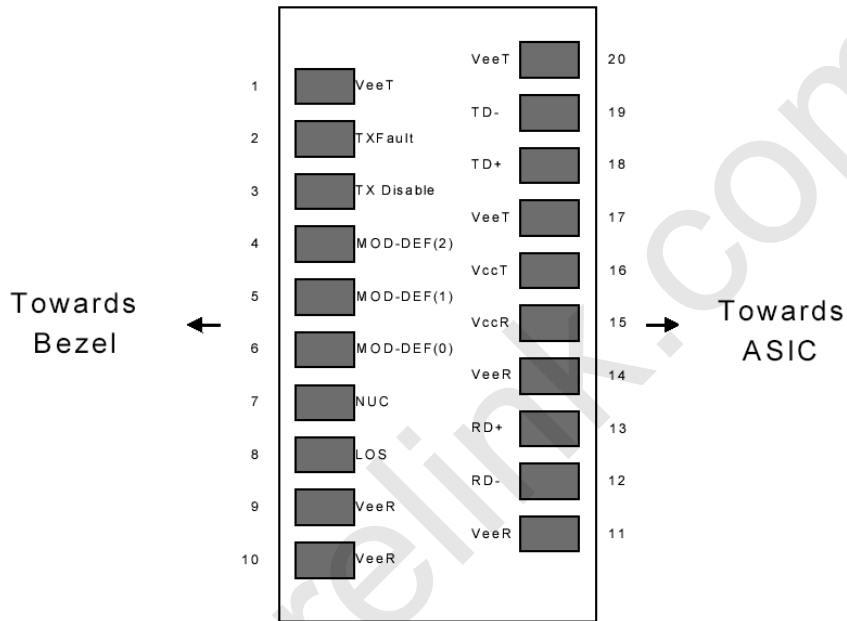


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accurate link budget based on specific conditions in your application.

Pin Assignment:

Diagram of Host Board Connector Block Pin Numbers and Name



Pin Function Definitions

Pin No	Name	Function	Plug Seq	Notes
1	VeeT	Transmitter Ground	1	1
2	TX Fault	Transmitter Fault Indication	3	
3	TX Disable	Transmitter Disable	3	2
4	MOD-DEF2	Module Definition	2	3
5	MOD-DEF1	Module Definition 1	3	3
6	MOD-DEF0	Module Definition 0	3	3
7	Rate Select	Not Connected	3	4
8	LOS	Loss of Signal	3	5



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9	VeeR	Receiver Ground	1	1
10	VeeR	Receiver Ground	1	1
11	VeeR	Receiver Ground		1
12	RD-	Inv. Received Data Out	3	6
13	RD+	Received Data Out	3	6
14	VeeR	Receiver Ground	3	1
15	VccR	Receiver Power	2	1
16	VccT	Transmitter Power	2	
17	VeeT	Transmitter Ground	1	
18	TD+	Transmit Data In	3	6
19	TD-	Inv. Transmit In	3	6
20	VeeT	Transmitter Ground	1	

Notes:

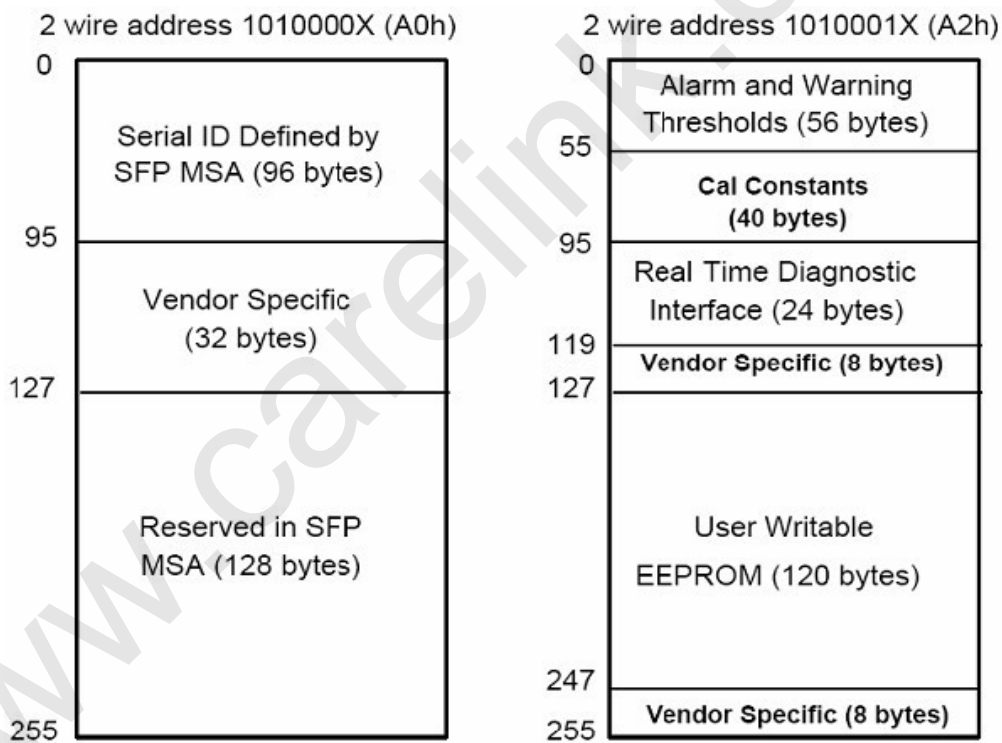
1. Circuit ground is internally isolated from chassis ground.
2. Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
3. Should be pulled up with 4.7k - 10 kohms on host board to a voltage between 2.0V and 3.6V.
MOD_DEF(0) pulls line low to indicate module is plugged in.
4. Rate select is not used
5. LOS is open collector output. Should be pulled up with 4.7k – 10 kohms on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.
6. AC Coupled



Information and Management

The SFP modules implement the 2-wire serial communication protocol as defined in the SFP -8472. The serial ID information of the SFP modules and Digital Diagnostic Monitor parameters can be accessed through the I²C interface at address A0h and A2h. The memory is mapped in Table 1. Detailed ID information (A0h) is listed in Table 2. And the DDM specification at address A2h. For more details of the memory map and byte definitions, please refer to the SFF-8472, “Digital Diagnostic Monitoring Interface for Optical Transceivers”. The DDM parameters have been internally calibrated.

Table 1. Digital Diagnostic Memory Map (Specific Data Field Descriptions)





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Table 2 - EEPROM Serial ID Memory Contents (A0h)

Data Address	Length (Byte)	Name of Length	Description and Contents
Base ID Fields			
0	1	Identifier	Type of Serial transceiver (03h=SFP)
1	1	Reserved	Extended identifier of type serial transceiver (04h)
2	1	Connector	Code of optical connector type (07=LC)
3-10	8	Transceiver	
11	1	Encoding	NRZ(03h)
12	1	BR, Nominal	Nominal baud rate, unit of 100Mbps
13-14	2	Reserved	(0000h)
15	1	Length(9um)	Link length supported for 9/125um fiber, units of 100m
16	1	Length(50um)	Link length supported for 50/125um fiber, units of 10m
17	1	Length(62.5um)	Link length supported for 62.5/125um fiber, units of 10m
18	1	Length(Copper)	Link length supported for copper, units of meters
19	1	Reserved	
20-35	16	Vendor Name	SFP vendor name: Carelink
36	1	Reserved	
37-39	3	Vendor OUI	SFP transceiver vendor OUI ID
40-55	16	Vendor PN	Part Number: "CL-SFP-MD40-XX4,5 DD" (ASCII)
56-59	4	Vendor rev	Revision level for part number
60-62	3	Reserved	
63	1	CCID	Least significant byte of sum of data in address 0-62



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Extended ID Fields			
64-65	2	Option	Indicates which optical SFP signals are implemented (001Ah = LOS, TX_FAULT, TX_DISABLE all supported)
66	1	BR, max	Upper bit rate margin, units of %
67	1	BR, min	Lower bit rate margin, units of %
68-83	16	Vendor SN	Serial number (ASCII)
84-91	8	Date code	Carelink's Manufacturing date code
92-94	3	Reserved	
95	1	CCEX	Check code for the extended ID Fields (addresses 64 to 94)
Vendor Specific ID Fields			
96-127	32	Readable	Carelink specific data, read only
128-255	128	Reserved	Reserved for SFF-8079

Digital Diagnostic Monitor Characteristics

Data Address	Parameter	Accuracy	Unit
96-97	Transceiver Internal Temperature	±6.0	°C
98-99	VCC3 Internal Supply Voltage	±5.0	%
100-101	Laser Bias Current	±10	%
102-103	Tx Output Power	±3.0	dBm
104-105	Rx Input Power	±3.0	dBm



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Regulatory Compliance

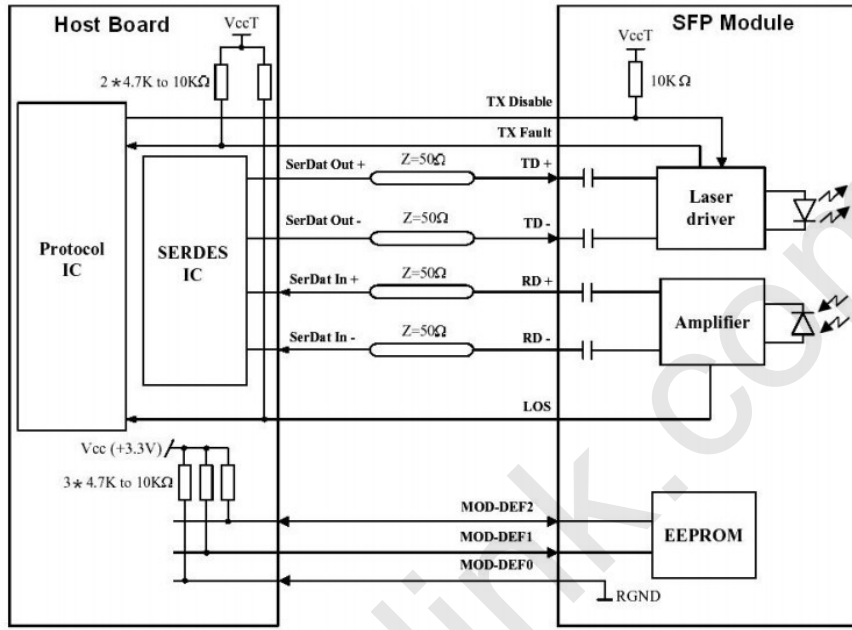
The CL-SFP-MD40-XX/4,5 DD complies with international Electromagnetic Compatibility (EMC) and international safety requirements and standards (see details in Table following).

Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883E Method 3015.7	Class 1(>1000 V)
Electrostatic Discharge (ESD) to the Duplex LC Receptacle	IEC 61000-4-2 GR-1089-CORE	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022 Class B (CISPR 22B) VCCI Class B	Compatible with standards
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN60950, EN (IEC) 60825-1,2	Compatible with Class 1 laser product.



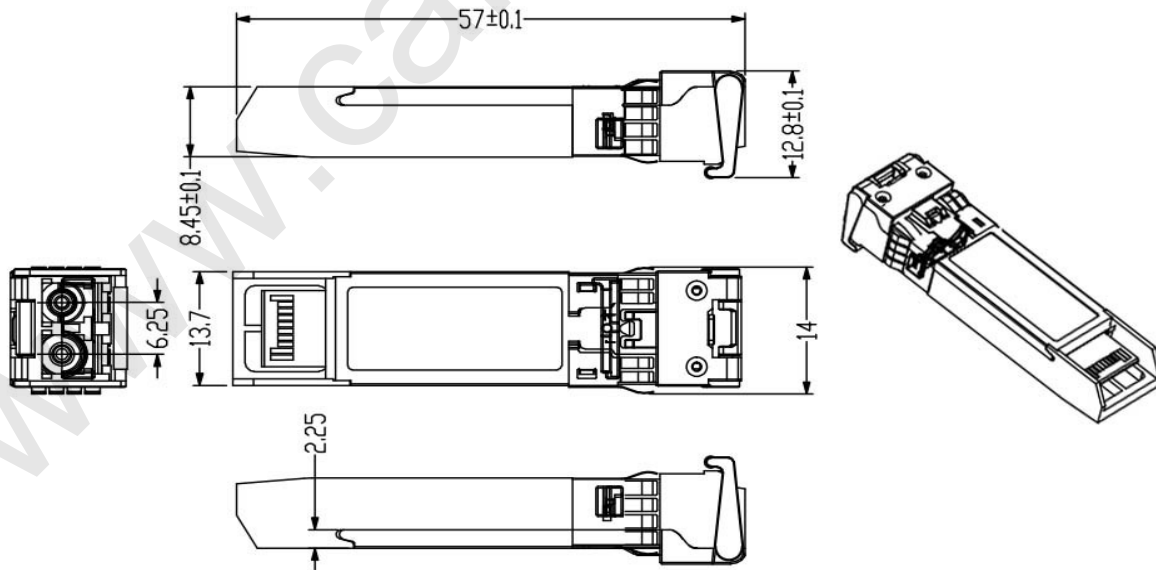
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Recommended Circuit:



Recommended High-speed Interface Circuit

Mechanical Dimensions:



Mechanical Drawing



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Order Information:

CL-SFP-MD40-XX/4,5 DD : 100GHZ ITU Grid Channel No.

Part No.	Central Wavelength(nm)	Frequency (THZ)
CL-SFP-MD40-61/4,5 DD	1528.77	196.1
CL-SFP-MD40-60/4,5 DD	1529.55	196.0
CL-SFP-MD40-59/4,5 DD	1530.33	195.9
CL-SFP-MD40-58/4,5 DD	1531.12	195.8
CL-SFP-MD40-57/4,5 DD	1531.90	195.7
CL-SFP-MD40-56/4,5 DD	1532.68	195.6
CL-SFP-MD40-55/4,5 DD	1533.47	195.5
CL-SFP-MD40-54/4,5 DD	1534.25	195.4
CL-SFP-MD40-53/4,5 DD	1535.04	195.3
CL-SFP-MD40-52/4,5 DD	1535.82	195.2
CL-SFP-MD40-51/4,5 DD	1536.61	195.1
CL-SFP-MD40-50/4,5 DD	1537.40	195.0
CL-SFP-MD40-49/4,5 DD	1538.19	194.9
CL-SFP-MD40-48/4,5 DD	1538.98	194.8
CL-SFP-MD40-47/4,5 DD	1539.77	194.7
CL-SFP-MD40-46/4,5 DD	1540.56	194.6
CL-SFP-MD40-45/4,5 DD	1541.35	194.5
CL-SFP-MD40-44/4,5 DD	1542.14	194.4
CL-SFP-MD40-43/4,5 DD	1542.94	194.3



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CL-SFP-MD40-42/4,5 DD	1543.73	194.2
CL-SFP-MD40-41/4,5 DD	1544.53	194.1
CL-SFP-MD40-40/4,5 DD	1545.32	194.0
CL-SFP-MD40-39/4,5 DD	1546.12	193.9
CL-SFP-MD40-38/4,5 DD	1546.92	193.8
CL-SFP-MD40-37/4,5 DD	1547.72	193.7
CL-SFP-MD40-36/4,5 DD	1548.51	193.6
CL-SFP-MD40-35/4,5 DD	1549.32	193.5
CL-SFP-MD40-34/4,5 DD	1550.12	193.4
CL-SFP-MD40-33/4,5 DD	1550.92	193.3
CL-SFP-MD40-32/4,5 DD	1551.72	193.2
CL-SFP-MD40-31/4,5 DD	1552.52	193.1
CL-SFP-MD40-30/4,5 DD	1553.33	193.0
CL-SFP-MD40-29/4,5 DD	1554.13	192.9
CL-SFP-MD40-28/4,5 DD	1554.94	192.8
CL-SFP-MD40-27/4,5 DD	1555.75	192.7
CL-SFP-MD40-26/4,5 DD	1556.55	192.6
CL-SFP-MD40-25/4,5 DD	1557.36	192.5
CL-SFP-MD40-24/4,5 DD	1558.17	192.4
CL-SFP-MD40-23/4,5 DD	1558.98	192.3
CL-SFP-MD40-22/4,5 DD	1559.79	192.2
CL-SFP-MD40-21/4,5 DD	1560.61	192.1
CL-SFP-MD40-20/4,5 DD	1561.42	192.0



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CL-SFP-MD40-19/4,5 DD	1562.23	191.9
CL-SFP-MD40-18/4,5 DD	1563.05	191.8
CL-SFP-MD40-17/4,5 DD	1563.86	191.7