

Supports 32G Fibre Channel SFP28 Optical Transceiver with DDM	IP-FFLS10M85CE
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## PRODUCT FEATURES

- Supports 28.05Gb/s aggregate bit rate
- Up to 70m on OM3 MMF and 100m on OM4 MMF
- Duplex LC receptacles
- Commercial case temperature: 0°C to 70°C
- Single 3.3V power supply
- Maximum power consumption 1 Watts
- Hot-pluggable SFP28 footprint
- 850nm VCSEL laser transmitter and PIN receiver
- Support Digital Diagnostic Monitor interface

## APPLICATIONS

- 32G Fibre Channel
- Other Optical links

## COMPLIANCE

- SFF-8472
- SFF-8432
- SFF-8431
- FC-PI-6
- RoHS 2.0

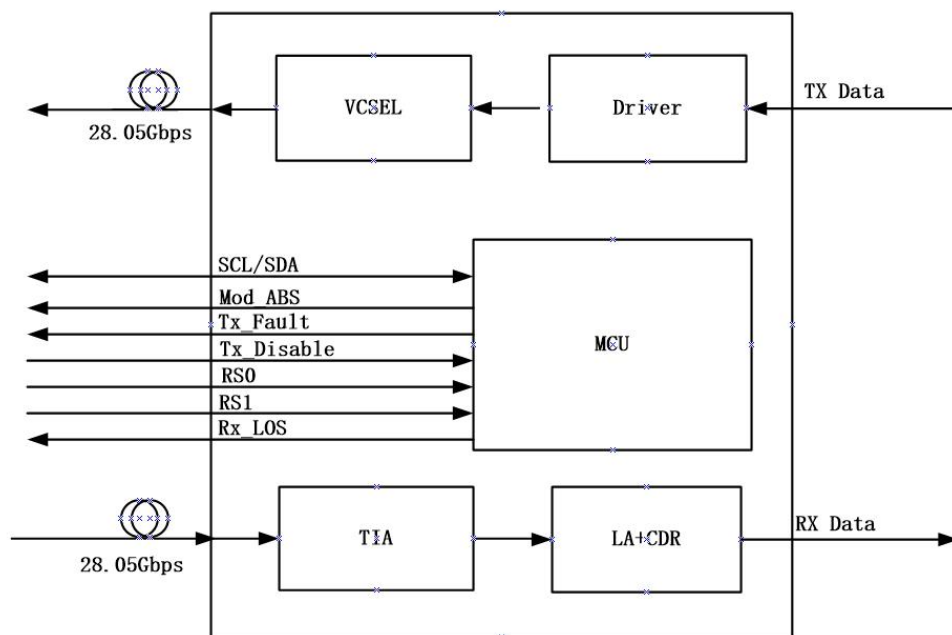
## Ordering information

Part Number	Data Rate (Gb/s)	Media	Wavelength(nm)	Operating distance(m)	Temperature(°C)
IP-FFLS10M85CE	28.05	MMF	850	100	0 ~ 70

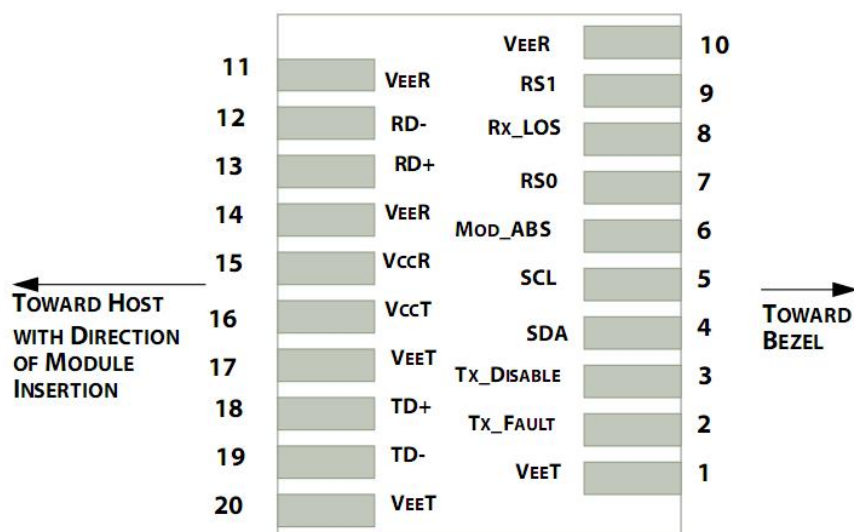
## Product Description

IP-FFLS10M85CE is designed for 32 Gigabit Fibre Channel links and other optical links over multi-mode fiber. It is a high performance module for short-range data communication and interconnect applications which operate at 28.05Gbps up to 70m using OM3 fiber or 100m using OM4 fiber. The product is RoHS compliant and lead-free per Directive 2011/65/EU.

## 1. Block Diagram



## 2. Pin Diagram



Pin out of Connector Block on Host Board

### 3. Pin Descriptions

Pin	Symbol	Description	Notes
1	V <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1
2	T <sub>FAULT</sub>	Transmitter Fault.	2
3	T <sub>DIS</sub>	Transmitter Disable. Laser output disabled on high or open.	3
4	SDA	2-wire Serial Interface Data Line	4
5	SCL	2-wire Serial Interface Clock Line	4
6	MOD_ABS	Module Absent. Grounded within the module	5
7	RS0	Rate Select 0, optionally controls SFP28 module receiver	
8	LOS	Loss of Signal indication. Logic "0" indicates normal operation.	6
9	RS1	Rate Select 1, optionally controls SFP28 module transmitter	
10	V <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground)	1
11	V <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground)	1
12	RD-	Receiver Inverted DATA out.AC Coupled	
13	RD+	Receiver Non-inverted DATA out.AC Coupled	
14	V <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground)	1
15	V <sub>CCR</sub>	Receiver Power Supply	
16	V <sub>CCT</sub>	Transmitter Power Supply	
17	V <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1
18	TD+	Transmitter Non-Inverted DATA in. AC Coupled.	
19	TD-	Transmitter Inverted DATA in. AC Coupled.	
20	V <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1

Notes:

1. Circuit ground is internally isolated from chassis ground.
2. TFAULT is an open collector/drain output, which is pulled up with a 4.7kΩ – 10kΩ resistor on the host board, but is grounded inside the SFP+ cable plug.
3. Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
4. Should be pulled up with 4.7kΩ – 10kΩ on host board to a voltage between 2.0V and 3.6V.
5. MOD\_ABS pull line low to indicate module is plugged in.
6. LOS is open collector output. Should be pulled up with 4.7kΩ – 10kΩ on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

### 4. Absolute Maximum Ratings

It has to be noted that the operation in excess of any individual absolute maximum ratings might cause permanent damage to this module.

Parameter	Symbol	Min	Typical	Max	Unit	Note
Maximum Supply Voltage	V <sub>CC</sub>	-0.5		3.6	V	
Storage Temperature	T <sub>s</sub>	-40		85	°C	
Relative Humidity	RH	0		85	%	

## 5. Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit	Note
Operating Case Temperature	$T_{case}$	0		70	°C	
Supply Voltage	$V_{CC}$	3.135	3.3	3.465	V	
Relative Humidity	$R_H$	5		85	%	
Data Rate (Optical)	$DR_O$		28.05		Gbps	
Data Rate (Electrical)	$DR_E$		28.05		Gbps	
Operating Link Distance				100	m	

## 6. Electrical Characteristics (EOL, TOP = 0 ~ 70°C, $V_{CC}$ = 3.135 to 3.465V)

Parameter	Symbol	Min	Typical	Max	Unit	Note
Power Dissipation				1	W	
Supply Current	$I_{CC}$			300	mA	
<b>Transmitter</b>						
Data Rate, each lane			28.05		Gbps	
Differential Input Voltage pk-pk	$V_{in,pp}$	200		800	mV	
Input differential impedance	$R_{in}$		100		Ohm	
Differential Termination Resistance Mismatch				10	%	
<b>Receiver</b>						
Data Rate, each lane			28.05		Gbps	
Output differential impedance	$R_{out}$		100		Ohm	
Differential Termination Resistance Mismatch				10	%	
Differential output voltage	$V_{out,pp}$	200		800	mV	

## 7. Optical Characteristics (EOL, TOP = 0 ~ 70°C, $V_{CC}$ = 3.135 to 3.465V)

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Transmitter						
Average Output Power	P <sub>OUT</sub>	-6.2		2	dBm	
Transmit OMA	T <sub>XOMA</sub>	-3.2			dBm	
Extinction Ratio	ER	2			dB	
Center Wavelength	λ <sub>C</sub>	840	850	860	nm	
RMS Spectral Width	σ			0.57	nm	
Vertical Eye Closure Penalty	VECP			3.13	dB	
Transmitter OFF Output Power	P <sub>Off</sub>			-30	dBm	
Transmitter eye mask definition {X1,X2,X3,Y1,Y2,Y3}		{0.3, 0.4, 0.45, 0.37, 0.40, 0.40}				1
Receiver						
Input Optical Wavelength	λ <sub>C</sub>	840	850	860	nm	
Rx Sensitivity	RSENS			-10.2	dBm	2
Receiver Stress Sensitivity, OMA				-5.8	dBm	
Return Loss of Receiver		12			dB	
Loss of Signal Assert	PA	-30			dBm	
Loss of Signal De-assert	PD			-12.5	dBm	
LOS Hysteresis	PD - PA	0.5		6	dB	

Notes:

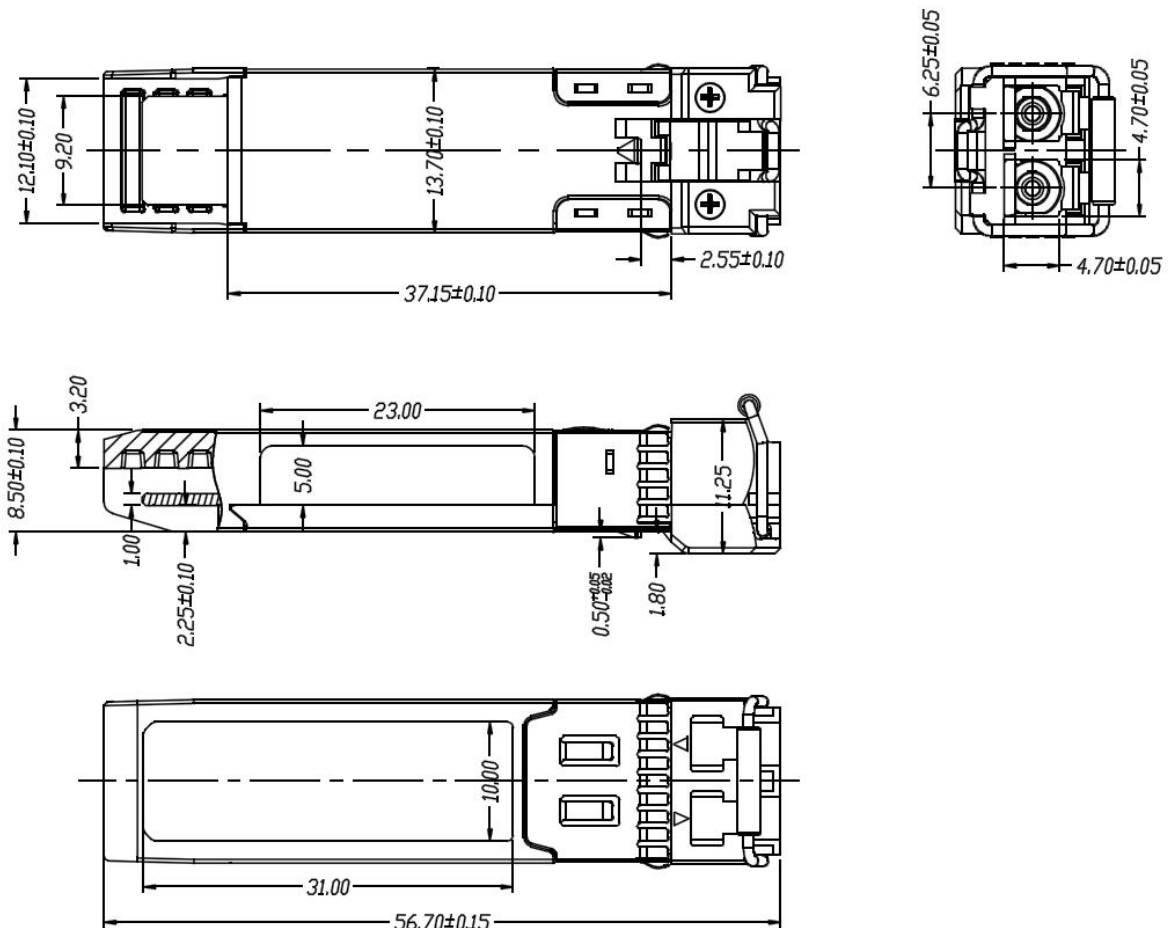
1. Hit ratio  $1.5 \times 10^{-3}$ .
2. Sensitivity is specified at BER@1E-6.

## 8. Digital Diagnostic Monitoring Functions

IP-FFLS10M85CE support the I<sup>2</sup>C-based Diagnostic Monitoring Interface (DMI) defined in document SFF-8472. The host can access real-time performance of transmitter and receiver optical power, temperature, supply voltage and bias current.

Parameter	Accuracy	Unit
Case Temperature	$\pm 3$	°C
Supply Voltage	$\pm 3\%$	V
Tx Bias Current	$\pm 10\%$	mA
Tx Optical Power	$\pm 3$	dB
Rx Optical Power	$\pm 3$	dB

## 9. Mechanical Specifications



**IP-FFLS10M85CE**

## 10. Regulatory Compliance

Feature	Reference	Performance
EMC	EN61000-3	Compatible with standards
Electrostatic Discharge (ESD)	IEC/EN 61000-4-2	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN 55022 Class B (CISPR 22A)	Compatible with standards
Laser Eye Safety	FDA 21CFR 1040.10, 1040.11 IEC/EN 60825-1, EC/EN 60825-2	Class 1 laser product
Component Recognition	IEC/EN 60950, L 60950	Compatible with standards
RoHS 2.0	2002/95/EC	Compatible with standards

## 11. Contact Information

Wuhan Inphilight Technology Company Limited

NO.4 Building,Bonded Optoelectronics Industrial Park,Wuhan East Lake Comprehensive Bonded Area,NO.777-30 Optics Valley 3rd Road,East Lake Hi-Technology Development Zone,Wuhan, Hubei, China

Email: sales@inphilight.com

## 12. Revision History

Version No.	Date	Description
1.0	Aug. 16, 2021.	Preliminary datasheet
1.1	Oct. 8,2021	Update contact Information
1.2	July 13, 2022	Modified the specifications of receiver return loss, optical power and the Differential Voltage
1.3	Jun.30, 2024	Update contact information.