FOC-M12-MNNA-TC...

M12 FO transceivers



Data sheet
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1 Description

The FO transceiver is available in two versions.

- **FOC-M12-MNNA-TC-1300** for applications with 50/125 µm, 62.5/125 µm or 200/230 µm fibers
- **FOC-M12-MNNA-TC-650** for applications with 980/1000 µm fibers

The FO transceiver features a high-speed transmitter and receiver circuit with a 1310 nm or 650 nm optical wavelength at high optical power. This makes the M12 transceiver an ideal alternative in data transmission systems with fiber optics.

An I^2C interface ensures that the transceiver is efficiently monitored and managed.

Due to the high data transmission rate of 125 Mbps, the optical characteristics, and connection technology for the fiber optics, the M12 transceiver offers a wealth of application options:

- Optical networks
- Fast Ethernet
- Industrial electronics
- Power electronics

1.1 Properties

- 125 Mbps
- +3.3 V power supply
- PECL inputs/outputs
- Signal Detect (SD) output
- I^2C management interface
- Metal housing
- Pin connector pattern in accordance with 61754-27
- Ambient temperature: -40°C... +85 °C
- RoHS-compliant

FOC-M12-MNNA-TC-1300

- 1310 nm wavelength
- -19°dBm output power (50/125 µm)
- -30 dBm receiver sensitivity
- Suitable for 50/125 µm, 62.5/125 µm and 200/230 µm

FOC-M12-MNNA-TC-650

- 650 nm wavelength
- -4 dBm output power (980/1000 µm)
- -20 dBm receiver sensitivity
- Suitable for 980/1000 µm

To optimize transmission performance and to achieve the maximum transmission path, correctly pre-assembled fiber optic connectors are required.

Loads that exceed the specified limit values can cause permanent damage to the component. The limit values represent the load limits of the component.

Make sure you always use the latest documentation.
It can be downloaded at phoenixcontact.net/products.

This data sheet is valid for all products listed on the following page:

2 Ordering data

Fiber optic transceiver

Description	Type	Order No.	Pcs. / Pkt.
M12 FO transceiver, duplex, wavelength: 650 nm for 125 Mbps, for POF and PCF fibers, for PCB mounting, M16 fastening thread, with sealing cap, including I^2C interface for transceiver monitoring and management	FOC-M12-MNNA-TC-650	1416716	1
M12 FO transceiver, duplex, wavelength: 1300 nm for 125 Mbps, for GOF fibers, for PCB mounting, M16 fastening thread, with sealing cap, including I^2C interface for transceiver monitoring and management	FOC-M12-MNNA-TC-1300	1416729	1

Accessories

Description		Type	Order No.	Pcs. / Pkt.
M12 fiber optic coupler, duplex, suitable for all fibers, with wall bracket, IP65 degree of protection		FOC-M12-BU/BU	1416677	1
Assembled FO cable, round cable, 980/1000 µm POF fibers, for installation inside buildings M12 FO to M12 FO	1 m	FOC-PN-B-1000/M12-C/SCRJ/1	1408865	1
	2 m	FOC-PN-B-1000/M12-C/SCRJ/2	1408864	1
	5 m	FOC-PN-B-1000/M12-C/SCRJ/5	1416648	1
Assembled FO cable, round cable, 980/1000 µm POF fibers, for installation inside buildings M12 FO to SCRJ/IP20	1 m	FOC-PN-B-1000/M12-C/M12-C/1	1408871	1
	2 m	FOC-PN-B-1000/M12-C/M12-C/2	1408870	1
	5 m	FOC-PN-B-1000/M12-C/M12-C/5	1416680	1
Assembled FO cable, round cable, 200/230 µm PCF-GI fibers, for installation inside buildings M12 FO to M12 FO	1 m	FOC-HCS-GI-1005/M12-C/M12-C/1	1408873	1
	2 m	FOC-HCS-GI-1005/M12-C/M12-C/2	1408872	1
	5 m	FOC-HCS-GI-1005/M12-C/M12-C/5	1416693	1
Assembled FO cable, round cable, 200/230 µm PCF-GI fibers, for installation inside buildings M12 FO to SCRJ/IP20	1 m	FOC-HCS-GI-1005/M12-C/SCRJ/1	1408867	1
	2 m	FOC-HCS-GI-1005/M12-C/SCRJ/2	1408866	1
	5 m	FOC-HCS-GI-1005/M12-C/SCRJ/5	1416651	1
Assembled FO cable, round cable, 50/125 µm GOF-MM fibers, for installation inside buildings M12 FO to M12 FO	1 m	FOC-M12-M12-GB02/2	1408874	1
	2 m	FOC-M12-M12-GB02/1	1408875	1
	5 m	FOC-M12-M12-GB02/5	1416703	1
Assembled FO cable, round cable, 50/125 µm GOF-MM fibers, for installation inside buildings M12 FO to LC duplex	1 m	FOC-M12-LC:A-GB02/1	1408869	1
	2 m	FOC-M12-LC:A-GB02/2	1408868	1
	5 m	FOC-M12-LC:A-GB02/5	1416664	1

3 Limit values

Loads that exceed the limit values can cause permanent damage to the component. The limit values represent the load limits of the component.

Continuous operation with these values is not recommended, as this may jeopardize the reliability of the component.

The FO transceiver, connectors, and couplings should only be mounted finger tight.

Limit values	
Operating temperature	-40 °C ... +85°C
Storage temperature	-40 °C ... +100°C
Soldering temperature 2 mm from housing, t ≤ 5 s	260°C
Supply voltage	4 V
Data input voltage	-0.5 V ... 4 V
Differential input voltage	2 V (peak-to-peak with FOC-M12-MNNA-TC-1300)
PECL output current	-50 mA ... +50 mA
Electrostatic air discharge in acc. with EN 61000-6-2	8 kV
Electrostatic contact discharge in acc. with EN 61000-6-2	4 kV
Immunity of electrical field in accordance with EN 61000-6-2	10 V/m

4 Technical data

General data	
Storage temperature	-40 °C ... 100 °C
Ambient temperature	-40 °C ... 85 °C
Supply voltage	3 V ... 3.6 V, typical 3.3 V
Differential input voltage	1 V ... 1.8 V, typical 1.4 V
Current carrying capacity	50 Ω
Data rate	125 Mbps
Humidity	5 % ... 95 %

Transmitter	FOC-M12-MNNA-TC-650	FOC-M12-MNNA-TC-1300
Maximum wavelength λ_{max}	625 nm ... 675 nm, typical 650 nm	1280 nm ... 1340 nm, typical 1310 nm
Average optical output voltage	-8 dBm ... -5 dBm 980/1000 µm, 50 % DC, NA 0.5	-21 dBm ... -18 dBm 50/125 µm, 50 % DC, NA 0.2
Current consumption	70 mA ... 80 mA	90 mA ... 120 mA
Rise time	2.5 ns	1.8 ns
Fall time	2.5 ns	1.8 ns
Data input current for logical “0”	at least -50 µA	at least -50 µA
Data input current for logical “1”	maximum +50 µA	maximum +50 µA
Data input voltage for logical “0”	-1.81 V ... -1.475 V	-1.81 V ... -1.475 V
Data input voltage for logical “1”	-1.165 V ... -0.88 V	-1.165 V ... -0.88 V

Receiver	FOC-M12-MNNA-TC-650	FOC-M12-MNNA-TC-1300
Maximum receiver sensitivity	-25 dBm	-31 dBm
Maximum input power	At least 2 dBm	at least -3 dBm
Current consumption	70 mA ... 80 mA	70 mA ... 80 mA (no load)
Threshold value for signal detection	-20 dBm	-29.2 dBm
Signal detection hysteresis	1.5 dB ... 6 dB, typical 3 dB	1.5 dB ... 5 dB, typical 2.5 dB
Maximum response time, signal detection	10 µs	10 µs
Maximum fall time, signal detection	10 µs	10 µs
Signal detection output voltage log. 0	-1.83 V ... -1.55 V	-1.83 V ... -1.55 V
Signal detection output voltage log. 1	-1.08 V ... -0.88 V	-1.08 V ... -0.88 V
Data output voltage log. 0	-1.83 V ... -1.55 V	-1.83 V ... -1.55 V
Data output voltage log. 1	-1.08 V ... -0.88 V	-1.08 V ... -0.88 V
Data output rise time 20 % ... 80 %	2.2 ns	2.2 ns
Data output fall time 80 % ... 20 %	2.2 ns	2.2 ns
Bit error rate	<1E-10 λ = 650 nm, at 125 Mbps, Pin = -10 dBm, PRBS23	<1E-10 λ = 1300 nm, at 125 Mbps, Pin = -10 dBm, PRBS23

5 Dimensions

5.1 Dimensional drawing

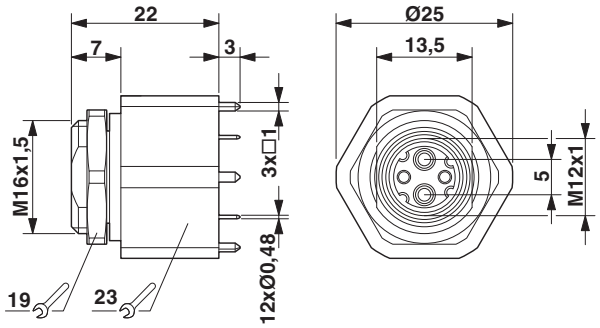


Figure 1 Dimensions (in mm)

5.2 Drilling diagram

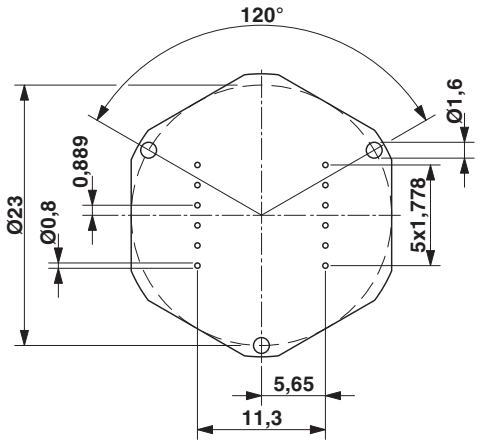


Figure 2 Drilling diagram (in mm)

6 Pin assignment

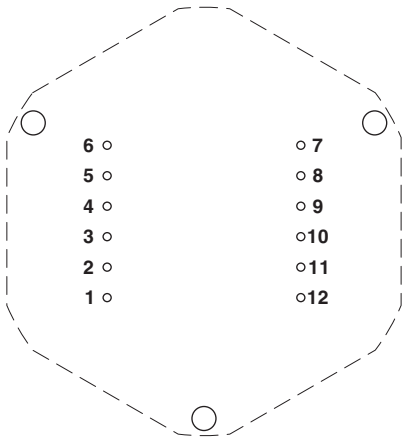


Figure 3 View of the component side

Pin	Name	Function
1	RD+	Receive Data Out+
2	RD-	Receive Data Out-
3	SD	Signal Detect
4	RxVcc	+3.3 V Receiver
5	RxGnd	GND Receiver
6	SDA	I^2C Serial Data IO
7	Sclk	I^2C Serial Clock Input
8	TD-	Transmit Data In-
9	TD+	Transmit Data In+
10	TxDis	Disable Transmitter Input
11	TxGnd	GND Transmitter
12	TxVcc	+3.3 V Transmitter

7 Notes

Mounting

The FO transceiver, connectors, and couplings should only be mounted finger tight.

Achievable transmission paths

FOC-M12-MNNA-TC-1300 is designed for 50/125 µm fibers. The maximum achievable transmission paths are 2500m.

FOC-M12-MNNA-TC-650 is designed for 980/1000 µm fibers. The maximum achievable transmission paths are 75m.

To optimize transmission performance and to achieve the maximum transmission path, correctly pre-assembled fiber optic connectors are required.

8 External wiring

NOTE: To optimize the function of the transceiver, a decoupling of the supply voltage and a cable termination is required as shown in Figure 4.

NOTE: The decoupling capacitors and termination resistors should be as close as possible to the inputs of the transceiver or the LVPECL receiver.

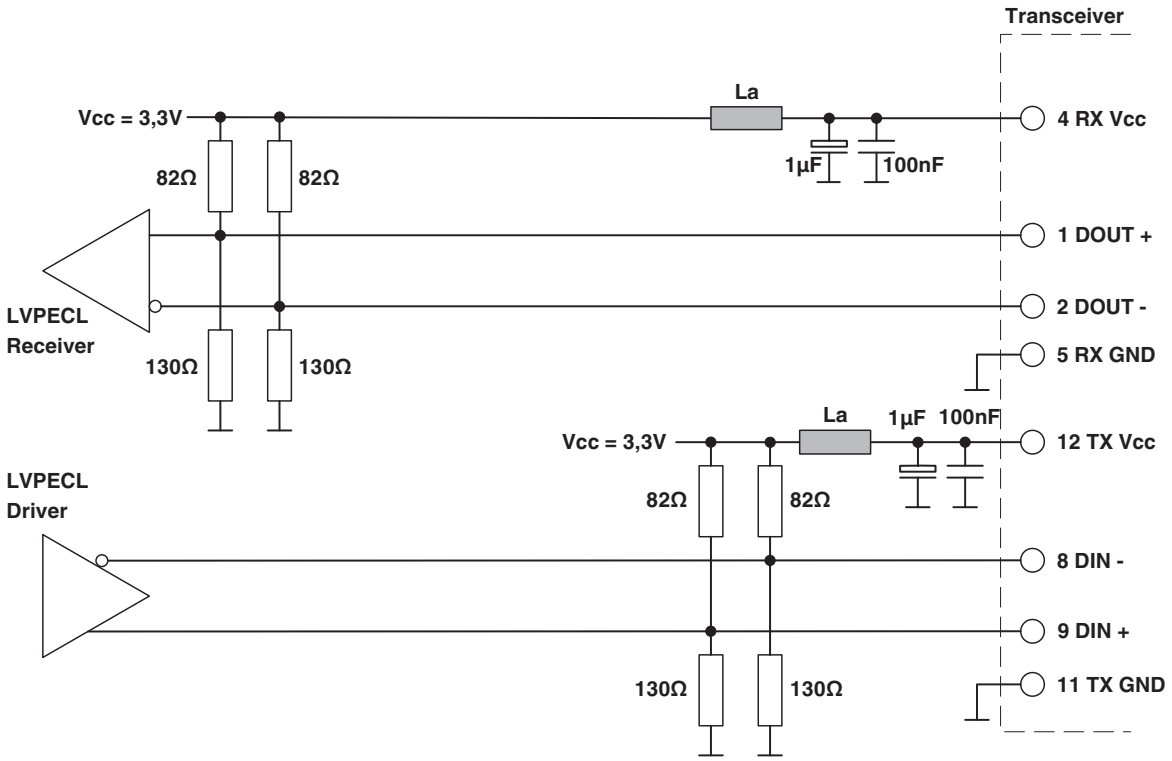


Figure 4 External wiring

Ferrites (La):

Typical impedance: 120 Ω at 100 MHz

Maximum DC resistance: 0.15 Ω at 200 mA

9 Block diagram

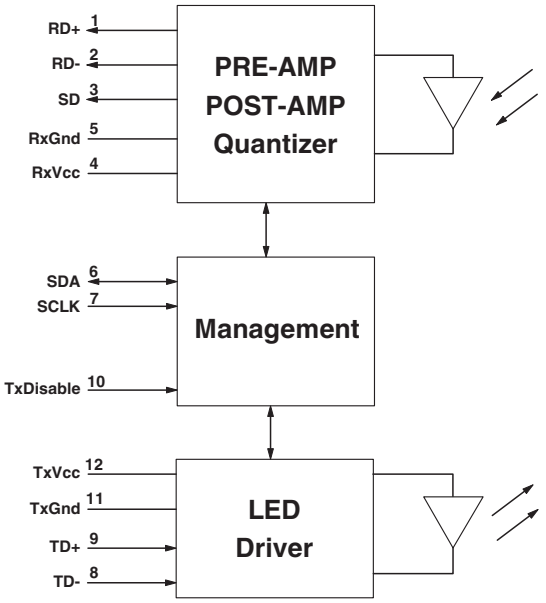


Figure 5 Block diagram

10 I²C interface

10.1 I²C addresses

Serial address = A0 (hex)			
Address (hex)	**Field size (byte)**	**Name**	**Description**
00-5F	96	Serial ID	GP NVRAM; R/W under valid OEM password
60-7F	32	Vendor Specific	Vendor-specific EEPROM
80-FF	128	Reserved	Reserved for future use

Serial address = A2 (hex)			
Address (hex)	**Field size (byte)**	**Name**	**Description**
00-27	40	Alarm and Warning Threshold	High/low limits for warnings and alarms
28-37	16	Reserved	Reserved – do not write; reads undefined
38-5B	36	Calibration Constants	Numerical constants for external calibration
5C-5E	3	Reserved	Reserved – do not write; reads undefined
5F	1	Checksum	GP NVRAM; R/W under valid OEM password
60-69	10	Analog Data	Real-time analog parameter data
6A-6D	4	Reserved	Reserved – do not write; reads undefined
6E	1	Control/Status Bits	Control and status bits
6F	1	Reserved	Reserved – do not write; reads undefined
70-71	2	Alarm Flags	Alarm status bits; read only
72-73	2	Reserved	Reserved – do not write; reads undefined
74-75	2	Warning Flags	Warning status bits; read only

Serial address = A2 (hex) [...]			
Address (hex)	**Field size (byte)**	**Name**	**Description**
76-77	2	Reserved	Reserved – do not write; reads undefined
78-7B	4	OEMPW	OEM password entry field
7C-7F	4	Reserved	Reserved – do not write; reads undefined
80-F7	120	User Scratchpad	User writeable EEPROM
F8-F9	2	Reserved	Reserved – do not write; reads undefined
FA	1	USRPWSET	User password setting; read/write using any password; returns zero otherwise
FB	1	USRPW	Entry field for user password
FC-FD	2	POH	Power ON hour meter result; read only;
FE	1	Data Ready Flags	Data ready bits for each measured parameter; read only
FF	1	User Control	End-user control and status bits

Serial address = A4 (hex)			
Address (hex)	**Field size (byte)**	**Name**	**Description**
00-3F	64	APCLUTn	APC look-up table
40-7F	64	MODLUTn	VMOD look-up table
80-BF	64	IFLTUT	Bias current fault threshold look-up table
C0-FF	64	EOLLUTn	Bias current high alarm look-up table

Serial address = A6 (hex)			
Address (hex)	**Field size (byte)**	**Name**	**Description**
00	1	OEMCFG0	Control and status bits
01	1	OEMCFG1	Control and status bits
02	1	OEMCFG2	Control and status bits
03	1	APCSET0	APC setpoint 0
04	1	APCSET1	APC setpoint 1
05	1	APCSET2	APC setpoint 2
06	1	MODSET	DAC setpoint
07	1	IBFLT	Bias current fault comparator threshold
08	1	TXPFLT	TX power fault threshold
09	1	LOSFLT	RX loss fault comparator threshold
0A	1	FLTTMR	Fault comparator masking interval timer setting
0B	1	FLTMSK	Fault source mask bits
0C-0F	2	OEMPWSET	OEM area access password
10	1	OEMCAL0	OEM calibration register 0
11	1	OEMCAL1	OEM calibration register 1
12	1	LUTINDX	Look-up table index read-back
13	1	Reserved	Reserved for future use
14	1	APCDAC	Reads back current APC DAC setting
15	1	MODDAC	Reads back current MOD setting
16	1	OEMREAD	Reads back OEM calibration data
17	1	LOSFLTn	LOS deassert threshold
18	1	RXPOT	RX-pot tab selection
19	1	OEMCFG4	Starts selection bits

Serial address = A6 (hex) [...]			
Address (hex)	**Field size (byte)**	**Name**	**Description**
1A-1F	6	Reserved	Reserved for future use
20-27	8	POHDATA	Power ON hour meter scratchpad
28-47	32	RXLUT RX	Power calibration look-up table
48-49	2	Reserved	Reserved for future use
4A-57	18	CAL	Internal calibration slope and offset data
59-7D	37	Reserved	Reserved for future use
7E-FD	128	SCRATCH	Scratchpad area
FE	1	MFG_ID	42
FF	1	DEV_ID	Device and die revision

10.2 I^2C interface

I^2C interface			
Parameter	**Symbol**	**Value**	**Unit**
Low output voltage	V_{OL}	0.8 V	(max.)
High input voltage	V_{IH}	2.1 V	(min.)
Clock period	t1	2.5 µs	(min.)
Data IN setup time	t2	100 ns	(min.)
Data OUT stable	t3	300 ns	(min.)
Data low to Clk low	t4	100 ns	(min.)
Data high to Clk high	t5	100 ns	(min.)

10.3 I^2C timing

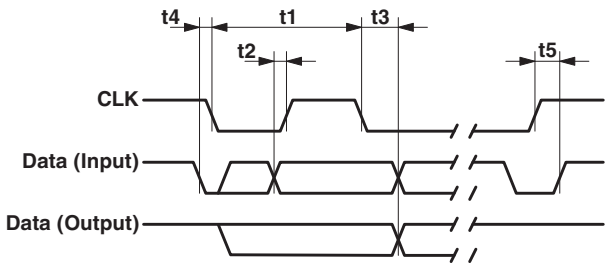


Figure 6 I^2C timing