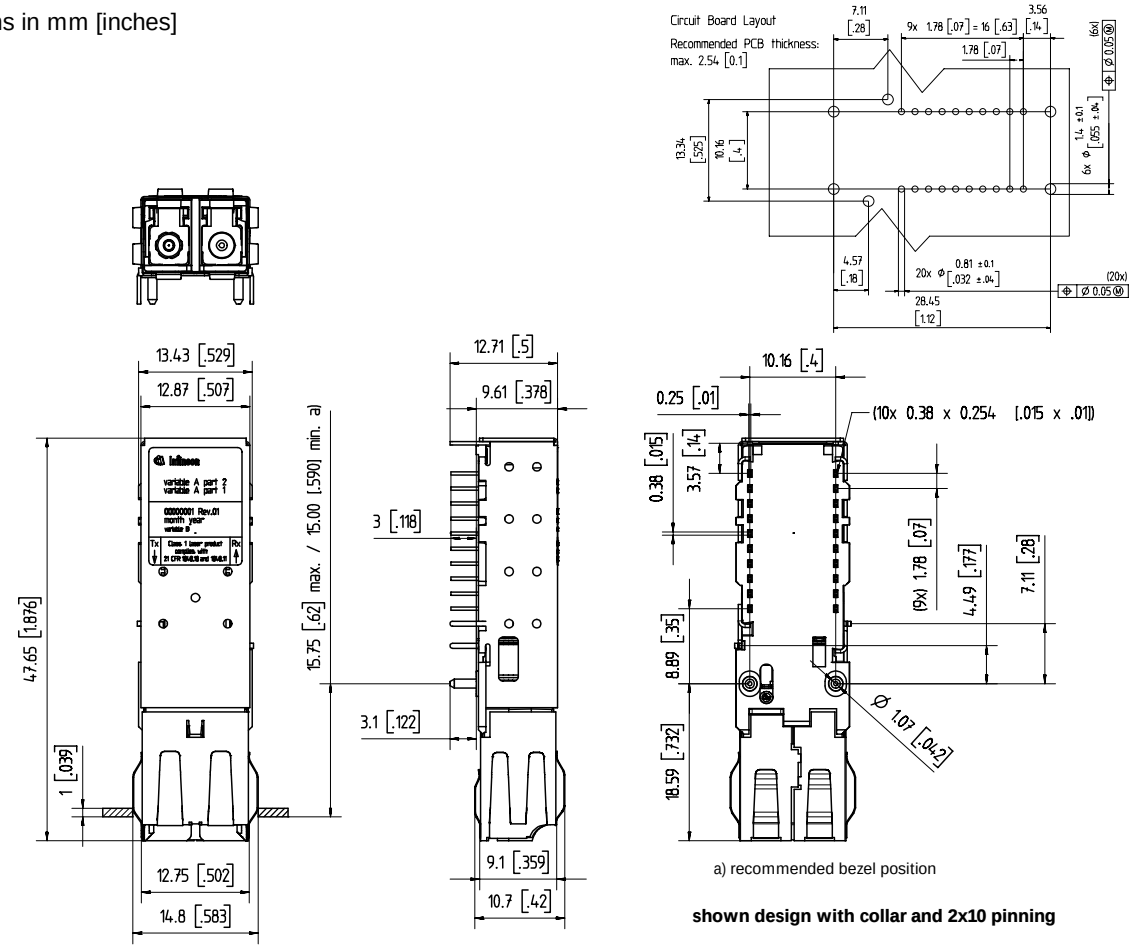
V23818-K15-Lx(*)

Small Form Factor
Single Mode 1300 nm 1.0625 GBd Fibre Channel
1.25 Gigabit Ethernet Transceiver
2x5/2x10 Pinning with LC™ Connector, with Collar

Preliminary

Dimensions in mm [inches]



***) Ordering Information**

In-put	Out-put	Signal detect	Pin-ning	Temperature Range	Part Number
DC	DC	PECL	2x5	0°C to 70°C	V23818-K15-L37
DC	DC	PECL	2x5	–40°C to 85°C	V23818-K15-L36
AC	AC	TTL	2x5	0°C to 70°C	V23818-K15-L47
AC	AC	TTL	2x5	–40°C to 85°C	V23818-K15-L46
DC	DC	PECL	2x10	0°C to 70°C	V23818-K15-L17
DC	DC	PECL	2x10	–40°C to 85°C	V23818-K15-L16
AC	AC	TTL	2x10	0°C to 70°C	V23818-K15-L57
AC	AC	TTL	2x10	–40°C to 85°C	V23818-K15-L56

LC™ is a trademark of Lucent

FEATURES

- **Small Form Factor transceiver**
- **RJ-45 style LC™ connector system**
- **Half the size of SC Duplex 1x9 transceiver**
- **Single power supply (+3.3 V)**
- **Extremely low power consumption**
- **Loss of optical signal indicator**
- **Laser disable input**
- **PECL differential inputs and outputs**
- **Distance up to 10 km on Single Mode Fiber**
- **Class 1 FDA and IEC laser safety compliant**
- **Multisource footprint**
- **Small footprint for high channel density**
- **UL 94 V-0 certified**
- **Compliant with FCC (Class B) and EN 55022**
- **Tx and Rx power monitor**

Absolute Maximum Ratings

Exceeding any one of these values may destroy the device immediately.

Package Power Dissipation..... 1.5 W
Supply Voltage (V_{CC}–V_{EE}) ..... 4 V
Data Input Levels..... V_{CC}+0.5 to V_{EE}–0.5
Differential Data Input Voltage ..... 2.5 V
Operating Case Temperature
V23818-K15-L16/L36/L46/L56 .....–40°C to 85°C
V23818-K15-L17/L37/L47/L57 .....0°C to 70°C
Storage Ambient Temperature.....–40°C to 85°C
Soldering Conditions Temp/Time .....250°C/ 5.5 s

DESCRIPTION

The Infineon single mode transceiver is based on the Physical Medium Depend (PMD) sublayer and baseband medium, type 1000 Base-LX (Long Wavelength Laser) (IEEE 802.5) and complies with the Fibre Channel Physical and Signaling Interface (FC-PH), ANSI, XSI TT Fibre Channel Physical Standard Class 100-SM-LL-I, latest Revision.

The appropriate fiber optic cable is 9 µm single mode fiber with LC connector.

The Infineon single mode transceiver is a single unit comprised of a transmitter, a receiver, and an LC receptacle. This design frees the customer from many alignment and PC board layout concerns.

This transceiver supports the LC connectorization concept, which competes with UTP/CAT 5 solutions. It is compatible with RJ-45 style backpanels for fiber-to-the-desktop applications while providing the advantages of fiber optic technology. The receptacle accepts the new LC connector. The Small Form Factor is specially developed for distances of up to 10 km.

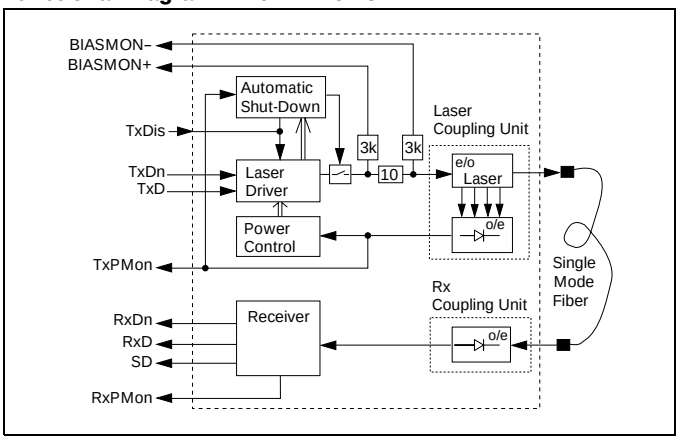
The module is designed for low cost LAN and WAN applications. It can be used as the network end device interface in mainframes, workstations, servers, and storage devices, and in a broad range of network devices such as bridges, routers, hubs, and local and wide area switches.

This transceiver operates at 1.0625 and 1.25 Gbit/s from a single power supply. The full differential data inputs and outputs are PECL compatible.

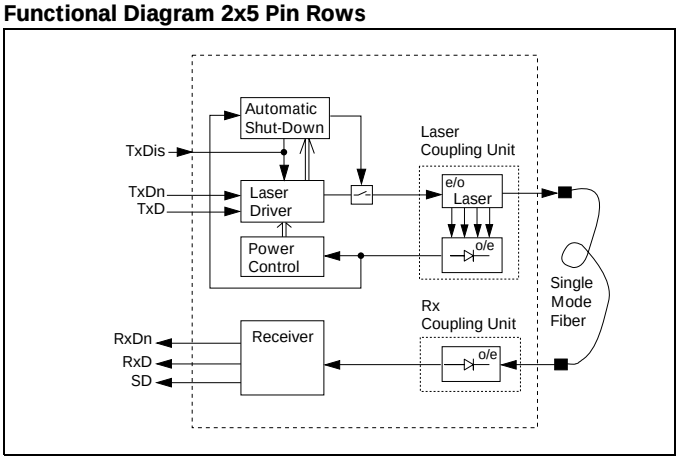
Functional Description of SFF Transceiver

This transceiver is designed to transmit serial data via single mode fiber.

Functional Diagram 2x10 Pin Rows



Functional Diagram 2x5 Pin Rows



2x10/2x5 Pin Rows

The receiver component converts the optical serial data into an electrical data (RD+ and RD–). The Signal Detect output (SD) shows whether an optical signal is present.

The transmitter part converts electrical PECL compatible serial data (TD+ and TD–) into optical serial data.

The module has an integrated shutdown function that switches the laser off in the event of an internal failure.

Reset is only possible if the power is turned off, and then on again. (V_{CC}Tx switched below V_{TH}).

2x10 Pin Rows

The transmitter contains a laser driver circuit that drives the modulation and bias current of the laser diode. The currents are controlled by a power control circuit to guarantee constant output power of the laser over temperature and aging. The power control uses the output of the monitor PIN diode (mechanically built into the laser coupling unit) as a controlling signal, to prevent the laser power from exceeding the operating limits.

TECHNICAL DATA

The electro-optical characteristics described in the following tables are valid only for use under the recommended operating conditions.

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Units
Case Temperature(1)	T_C	–40		85	°C
Case Temperature(2)		0		70	
Power Supply Voltage	V_{CC}–V_{EE}	3.15	3.3	3.45	V
Supply Current	I_{CC}			230	mA
Transmitter					
Data Input High Voltage	V_{IH}–V_{CC}	–1165		–880	mV
AC-coupled differential Data Input	V_{IDiff}	250		1600	
Data Input Low Voltage	V_{IL}–V_{CC}	–1810		–1475	
Data Input Rise/Fall time	t_i			120	ps
Receiver					
Input Center Wavelength	λ_{RX}	1260		1580	nm

Notes

1. for V23818-K15-L16/L36/L46/L56
2. for V23818-K15-L17/L37/L47/L57

Transmitter Electro-Optical Characteristics

Transmitter	Symbol	Min.	Typ.	Max.	Units
Output Power (Average)(1)	P_O	–9.5		–3	dBm
Center Wavelength	λ_C	1266		1360	nm
Spectral Width (RMS)	σ			4	
Extinction Ratio (Dynamic)	ER	8.2			dB
Reset Threshold for TxV_{CC}(2)	V_{TH}		2.7		V
Power on Delay(2)	t_{DEL}		30		ms
Jitter Generation	J_{GE}p-p				UI
	J_{GE}RMS				

Notes

1. Into single mode fiber, 9 µm diameter
2. Laser power is shut down if power supply is below V_{TH} and switched on if power supply is above V_{TH} after t_{RES}.

Receiver Electro-Optical Characteristics

Receiver	Symbol	Min.	Typ.	Max.	Units
Sensitivity (Average Power)(1)	P_N			–20	dBm
Saturation (Average Power)	P_{SAT}	–3			
Min. Optical Modulation Amplitude(11)	OMA			15	µW
Signal Detect Assert Level(2)	P_{SDA}			–21	dBm
Signal Detect Deassert Level(3,10)	P_{SDD}	–37			
Signal Detect Hysteresis	P_{SDA}–P_{SDD}		3		dB
Signal detect Asserttime(2)	t_{ASS}			0.1	ms
Signal detect Deasserttime(3)	t_{DAS}			0.35	
Receiver 3 dB cut off Frequency(10)				1.5	GHz
Receiver 10 dB cut off Frequency(10)				3	
Output Voltage(4)	V_{OH}–V_{CC}	–1110		–650	mV
Output Voltage(4)	V_{OL}–V_{CC}	–1800		–1300	
Output Voltage Swing(4)	V_{OH}–V_{OL}	500		1000	
Signal detect Output High Voltage PECL(5,7)	V_{SDH}–V_{EE}	V_{CC} –1200		V_{CC} –820	mV
Signal detect Output Low Voltage PECL(5,7)	V_{SDL}–V_{EE}	V_{CC} –1900		V_{CC} –1620	
Signal detect Output High Voltage TTL(5,8)	V_{SDH}	2.0			V
Signal detect Output Low Voltage TTL(5,8)	V_{SDL}			0.5	
Rx-Monitor(6,9)	Rx-Mon	0.5		1.0	A/W

Notes

1. Minimum average optical power at which the BER is less than 1 x 10 E–10. Measured with a 2^{23}–1 NRZ PRBS as recommended by ANSI T1E1.2, SONET OC-24, and ITU-T G.957.
2. An increase in optical power above the specified level will cause the SIGNAL DETECT to switch from a Low state to a High state (High active output)
3. A decrease in optical power below the specified level will cause the SIGNAL DETECT to switch from a High state to a Low state.
4. Load is 100 Ω differential.
5. Internal Load is 510 Ω to GND, no external load necessary. SIGNAL DETECT is a High active output. High Level means Signal is present, Low level means loss of signal.
6. Monitor current needs to be sunk to V_{CC}.
7. for V23818-K15-L16/L17/36/37
8. for V23818-K15-L46/L47/L56/L57
9. Only available on 2x10 modus: V23818-K15-L16/L17/56/57
10. Fibre Channel PI Standard.

Regulatory Compliance

Feature	Standard	Comments
ESD: Electrostatic Discharge to the Electrical Pins	EIA/JESD22-A114-A (MIL-STD 883D Method 3015.7)	Class 1 (>1000 V)
Immunity: Against Electro-static Discharge (ESD) to the Duplex LC Receptacle	EN 61000-4-2 IEC 61000-4-2	Discharges ranging from ±2 kV to ±15 kV on the receptacle cause no damage to transceiver (under recommended conditions).
Immunity: Against Radio Frequency Electro-magnetic Field	EN 61000-4-3 IEC 61000-4-3	With a field strength of 3 V/m rms, noise frequency ranges from 10 MHz to 2 GHz. No effect on transceiver performance between the specification limits.
Emission: Electromagnetic Interference (EMI)	FCC 47 CFR Part 15, Class B EN 55022 Class B CISPR 22	Noise frequency range: 30 MHz to 18 GHz

EYE SAFETY

This laser based single mode transceiver is a Class 1 product. It complies with IEC 60825-1 and FDA 21 CFR 1040.10 and 1040.11.

To meet laser safety requirements the transceiver shall be operated within the Absolute Maximum Ratings.

Caution

All adjustments have been made at the factory prior to shipment of the devices. No maintenance or alteration to the device is required.
Tampering with or modifying the performance of the device will result in voided product warranty.

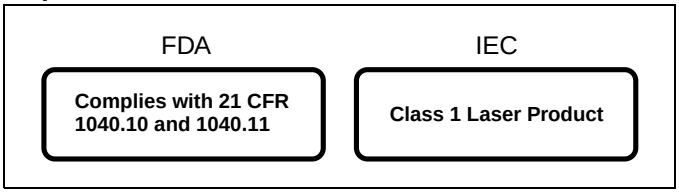
Note

Failure to adhere to the above restrictions could result in a modification that is considered an act of "manufacturing," and will require, under law, recertification of the modified product with the U.S. Food and Drug Administration (ref. 21 CFR 1040.10 (i)).

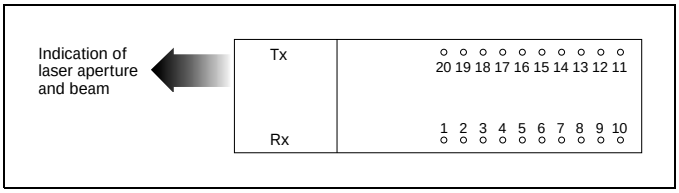
Laser Data

Wavelength	1300 nm
Total output power (as defined by IEC: 7 mm aperture at 14 mm distance)	less than 2 mW
Total output power (as defined by FDA: 7 mm aperture at 20 cm distance)	less than 180 µW
Beam divergence	tbd

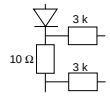
Required Labels



Laser Emission

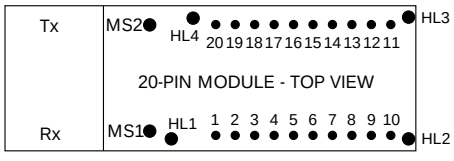


Pin Description

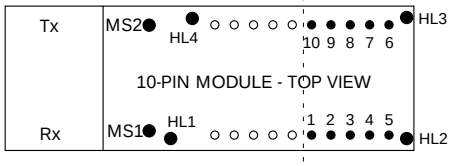
Pin Name		Level	Pin#	Description
2x10 Transceiver				
RxPMon	Rx Power Monitor	Analog Current	1	Do not connect if not used. See application note.
RxV_{EE}	Rx Ground	Power Supply	2, 3, 6	Negative power supply, normally ground
NC			4, 5	Pin not connected
RxV_{CC}	Rx +3.3 V	Power Supply	7	Positive power supply, +3.3 V
SD	Rx Signal Detect	PECL/TTL Output active high	8	A high level on this output shows that optical data is applied to the optical input. PECL Output active high for V23818-K15-L16/L17 TTL Output active high for V23818-K15-L56/L57
RxDn	Rx Output Data	PECL Output	9	Inverted receiver output data
RxD			10	Receiver output data
TxV_{CC}	Tx +3.3 V	Power Supply	11	Positive power supply, +3.3 V
TxV_{EE}	Tx Ground	Power Supply	12, 16	Negative power supply, normally ground
TxDis	Tx Disable/Enable	TTL Input	13	A low signal switches the laser on. A high signal switches the laser off.
TxD	Tx Input Data	PECL Input	14	Transmitter input data
TxDn			15	Inverted transmitter input data
Bias Mon	Bias Monitor 	Analog Voltage Bias Mon – Bias Mon +	 17 18	This output shows an analog voltage that is proportional to the laser bias current. Use this output to check proper laser operation and for end of life indications. Limit: Bias Current I_{BIAS} <60 mA $I_{BIAS} = \frac{U}{10\Omega}$
TxPMon	Tx Power Monitor	Analog Voltage PMon – PMon +	 19 20	This output is derived from the Tx monitor diode. See application note. Output Voltage Vmon=1.2 ±0.2 V, Source Resistance R_S=100 kΩ
2x5 Transceiver				
RxV_{EE}	Rx Ground	Power Supply	1	Negative power supply, normally ground
RxV_{CC}	Rx +3.3 V	Power Supply	2	Positive power supply, +3.3 V
SD	Rx Signal Detect	PECL/TTL Output active high	3	A high level on this output shows that optical data is applied to the optical input. PECL Output active high for V23818-K15-L36/L37 TTL Output active high for V23818-K15-L46/L47
RxDn	Rx Output Data	PECL Output	4	Inverted receiver output data
RxD			5	Receiver output data
TxV_{CC}	Tx +3.3 V	Power Supply	6	Positive power supply, +3.3 V
TxV_{EE}	Tx Ground	Power Supply	7	Negative power supply, normally ground
TxDis	Tx Disable/Enable	TTL Input	8	A low signal switches the laser on. A high signal switches the laser off.
TxD	Tx Input Data	PECL Input	9	Transmitter input data
TxDn			10	Inverted transmitter input data
2x10/2x5 Transceiver				
MS	Mounting Studs	N/A	MS1/2	Mounting Studs are provided for transceiver mechanical attachment to the circuit board. They also provide an optional connection of the transceiver to the equipment chassis ground.
HL	Housing Leads	N/A	HL1/2/3/4	The transceiver Housing Leads are provided for additional signal grounding. The holes in the circuit board must be included and be tied to signal ground. (See Application Notes).

Pin Informations

20 Pin Module



10 Pin Module



APPLICATION NOTES

EMI-Recommendation

To avoid electromagnetic radiation exceeding the required limits please read the following recommendations:

Whenever high speed Gigabit switching components are located on the PCB (also multiplexers, clock recoveries ...) any opening of the machine may generate radiation even at different locations. Thus every mechanical opening or aperture should be as small as possible.

On the board itself every data connection should be an impedance matched line (e.g. strip line, coplanar strip line). Data, Datanot should be routed symmetrically, via's should be avoided. A symmetrically matching resistor of 100 Ω should be placed at the end of each matched line. An alternative termination can be provided with a 50 Ω resistor at each (D, Dn). In DC coupled systems an artificial 50 Ω resistance can be achieved as follows: For 3.3 V: 125 Ω to V_{CC} and 82 Ω to V_{EE}, for 5 V: 82 Ω to V_{CC} and 125 Ω to V_{EE} at Data and Datanot. Please consider whether there is an internal termination inside an IC or a transceiver.

It is recommended that chassis GND and signal GND should remain separate if there are openings or apertures of the housing nearby. Sometimes signal GND is the most harmful source of radiation. Connecting chassis GND and signal GND at the plate/ bezel/ backside wall e.g. by means of a fiber optic transceiver may result in a huge amount of radiation. Even a capacitive coupling between signal GND and chassis may be harmful if it is too close to an opening or an aperture.

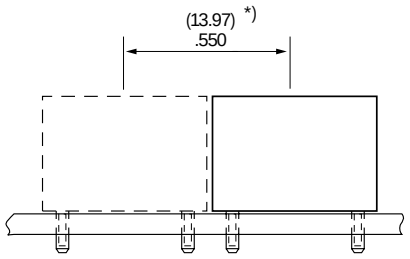
If a separation of signal GND and chassis GND is not possible, it is strongly recommended to provide a proper contact between signal GND and chassis GND at almost every location. This concept is suitable to avoid hotspots. Hotspots are places of highest radiation which could be generated if only a few connections between signal and chassis GND are available. Compensation currents would concentrate at these connections, causing radiation.

It is recommended to connect the Housing Leads to signal ground. Anyway it is also possible to connect them to chassis GND. This may provide a better EMI performance in some particular cases.

Please consider that the PCB may behave like a waveguide. With an ε_r of 4, the wavelength of the harmonics inside the PCB will be half of that in free space. In this case even small PCBs may have unexpected resonances.

Transceiver Pitch

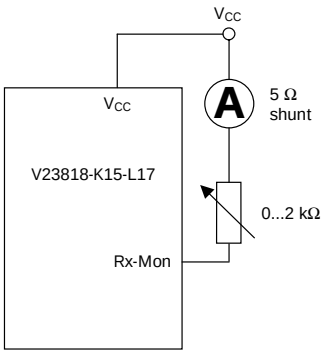
Dimensions in (mm) inches



*) min. pitch between SFF transceiver according to MSA.

Measurement Setup (simplified)

Current Measurement(1)

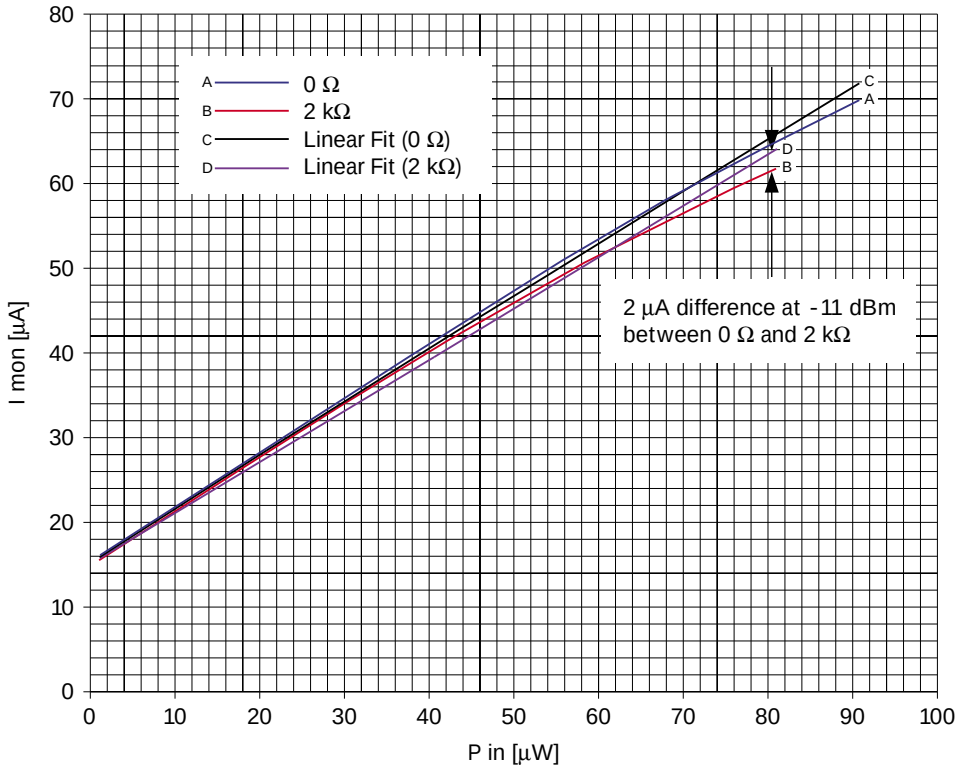


Note

1. See diagrams on page 7.

The following diagrams show the measurements plus a trendline added to each measurement.

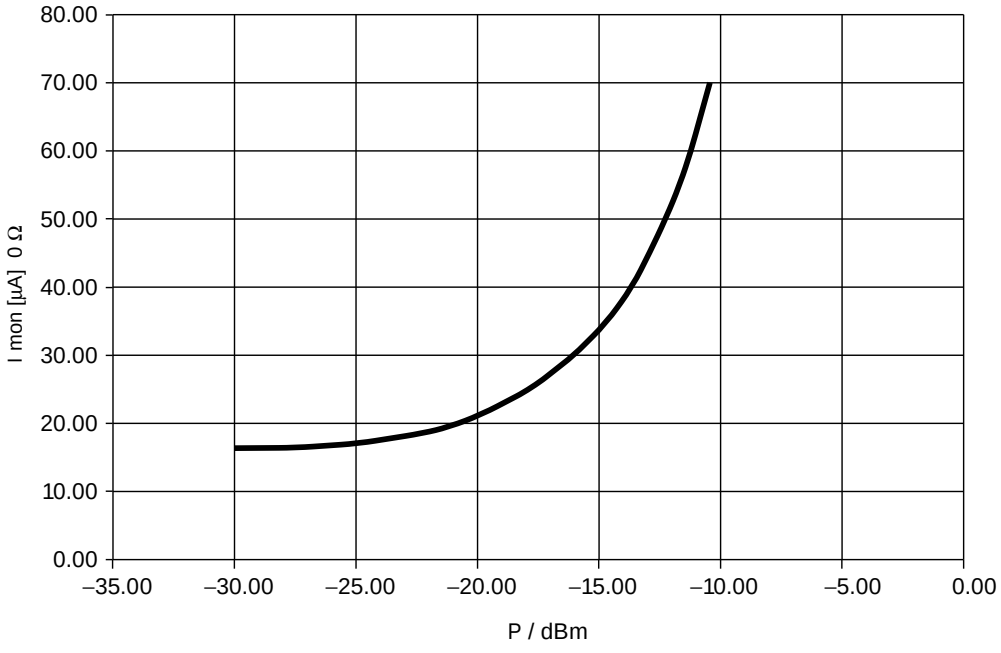
Result

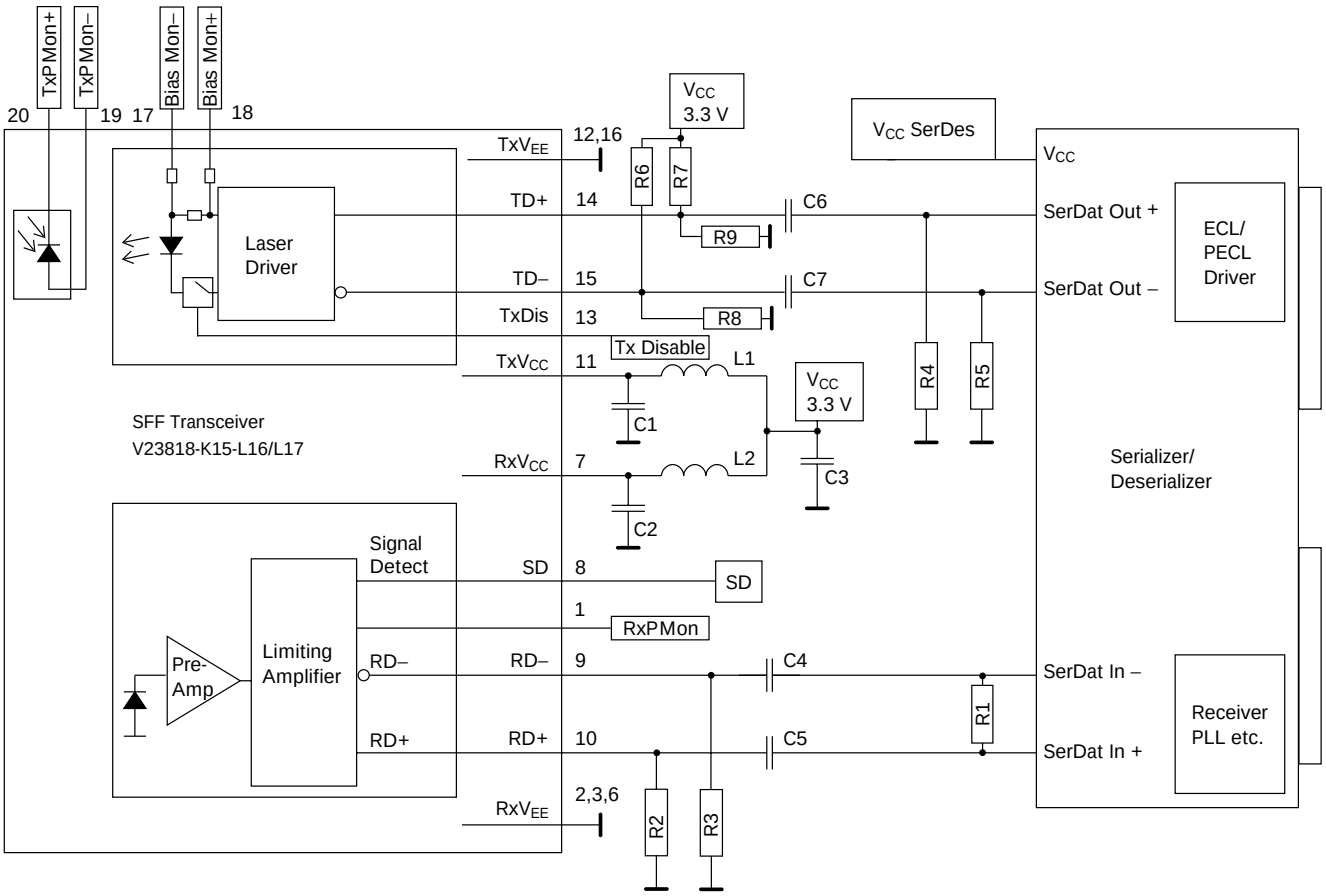


Rx Monitor on 2x10 Transceiver

The Rx monitor has a very linear characteristic. There are slight differences depending on the load. The optical input power was changed in the range of –11 dBm ... –30 dBm.

Logarithmic chart, typical curve

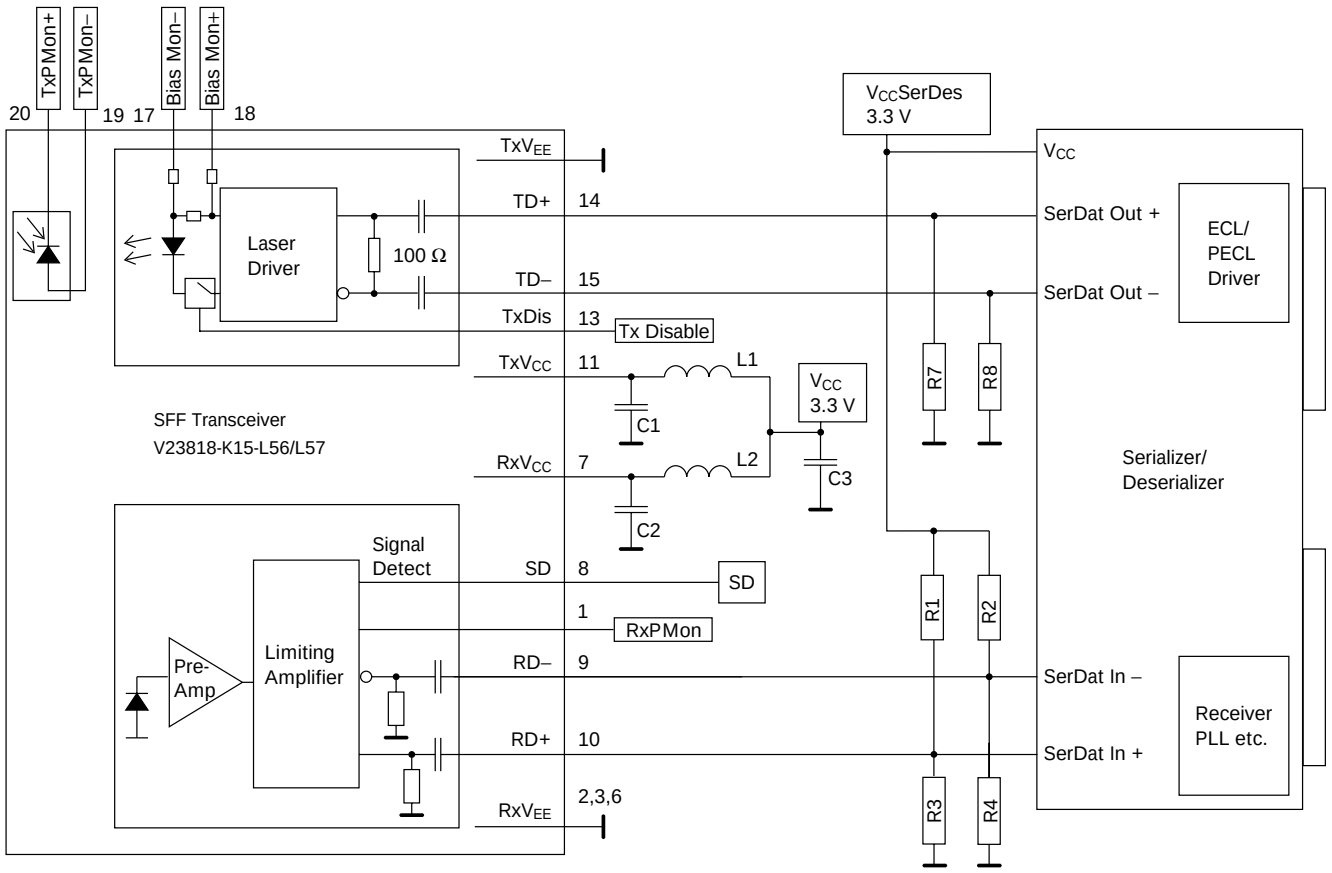




L1/2 = 1 ... 4.7 µH
C1/2/3 = 4.7 ... 10 µF
C4/5/6/7 = 100 nF
R1 = 100 Ω (if no biasing necessary for Deserializer and not termination inside)

R2/3 = 150 Ω
R4/5 = biasing for outputs depending on Serializer
R6/7 = 127 Ω
R8/9 = 82 Ω

Single Mode 1.0625 GBd 2x10 Transceiver AC/AC

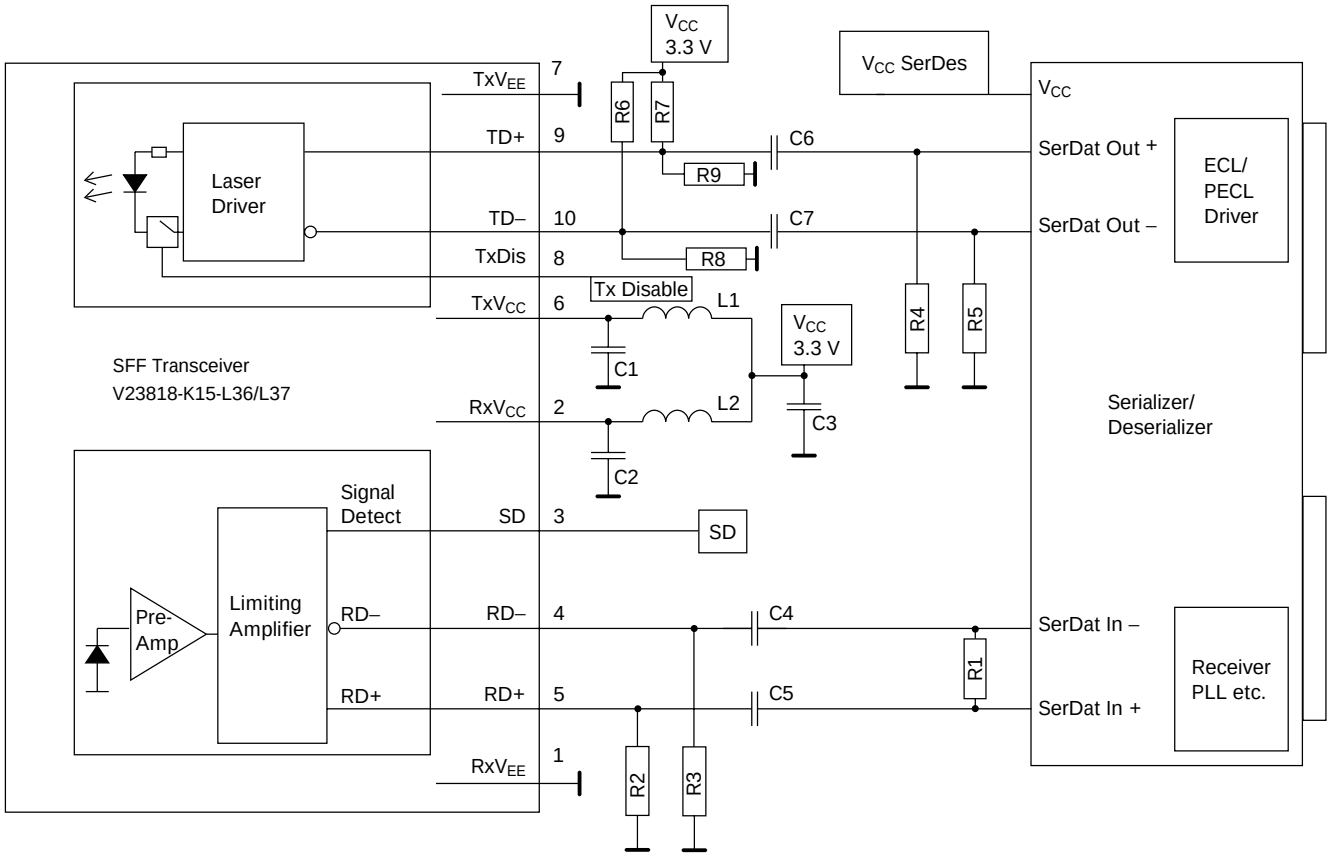


L1/2 = 1 ... 4.7 µH
C1/2/3 = 4.7 ... 10 µF
R1/2 = Depends on SerDes chip used
R3/4 = Depends on SerDes chip used

R7/8 = Biasing (depends on SerDes chip)
Place R1/2/3/4/7/8 close to SerDes chip
Place R5/6 close to Infineon transceiver

Values of R1/2/3/4 may vary as long as proper 50 Ω termination to V_{EE} or 100 Ω differential is provided. The power supply filtering is required for good EMI performance. Use short tracks from the inductor L1/L2 to the module V_{CC}Rx/V_{CC}Tx.

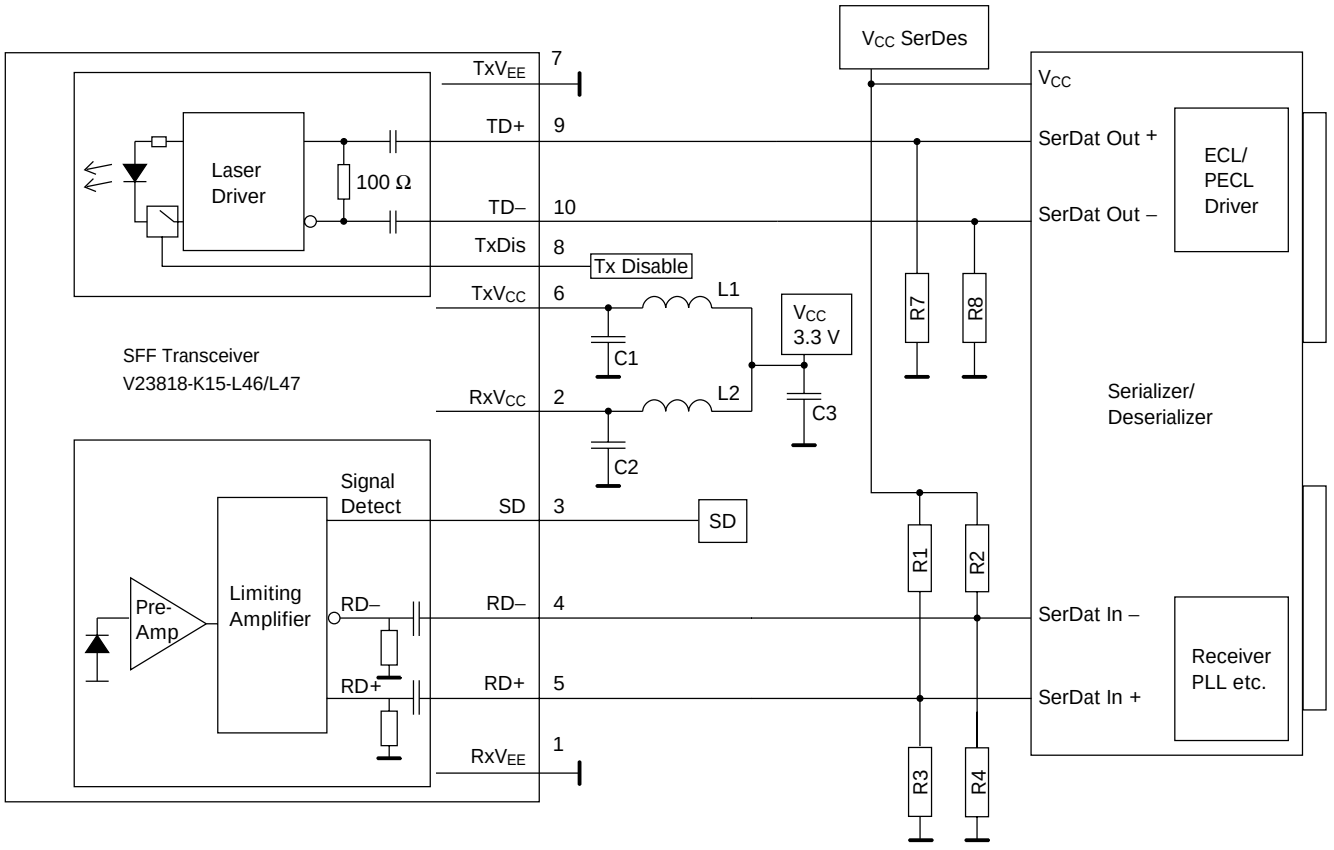
Single Mode 1.0625 GBd 2x5 Transceiver DC/DC



L1/2 = 1 ... 4.7 µH
C1/2/3 = 4.7 ... 10 µF
C4/5/6/7 = 100 nF
R1 = 100 Ω (if no biasing necessary for Deserializer and not termination inside)

R2/3 = 150 Ω
R4/5 = biasing for outputs depending on Serializer
R6/7 = 127 Ω
R8/9 = 82 Ω

Single Mode 1.0625 GBd 2x5 Transceiver AC/AC



L1/2 = 1 ... 4.7 µH
C1/2/3 = 4.7 ... 10 µF
R1/2 = Depends on SerDes chip used
R3/4 = Depends on SerDes chip used
R7/8 = Biasing (depends on SerDes chip)
Place R1/2/3/4/7/8 close to SerDes chip

Values of R1/2/3/4 may vary as long as proper 50 Ω termination to V_{EE} or 100 Ω differential is provided. The power supply filtering is required for good EMI performance. Use short tracks from the inductor L1/L2 to the module V_{CC}Rx/V_{CC}Tx.

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Attention please!

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We hereby disclaim any and all warranties, including but not limited to warranties of non-infringement, regarding circuits, descriptions and charts stated herein.
Infineon Technologies is an approved CECC manufacturer.

Information

For further information on technology, delivery terms and conditions and prices please contact the Infineon Technologies offices or our Infineon Technologies Representatives worldwide - see our webpage at
www.infineon.com/fiberoptics

Warnings

Due to technical requirements components may contain dangerous substances. For information on the types in question please contact your Infineon Technologies offices.
Infineon Technologies Components may only be used in life-support devices or systems with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support device or system, or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body, or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.

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