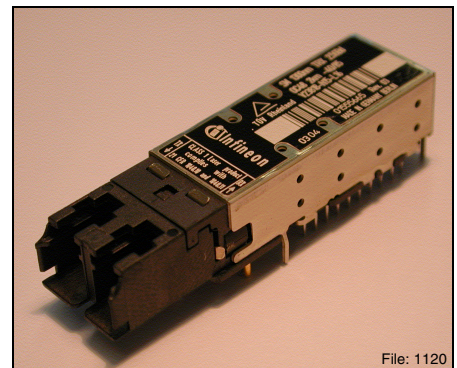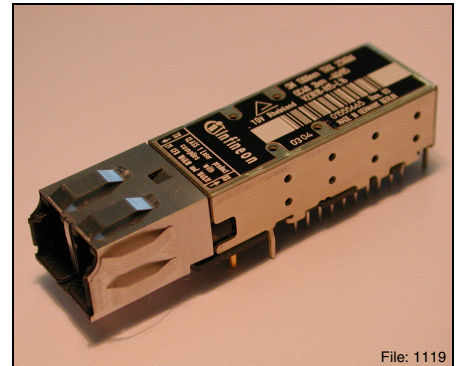# Small Form Factor
Single Mode 1300 nm
Multirate up to 155 Mbit/s Transceiver
2x5 Pinning with LC™ Connector

V23818-C18-Lxx/L4xx

Features

- Small Form Factor transceiver
- Multisource 2x5 footprint, SFF MSA compliant[1]
- Small footprint for high port density
- RJ-45 style LC™ connector system
- Half the size of SC Duplex 1x9 transceiver
- Single power supply (3.3 V)
- Extremely low power consumption, 600 mW typical
- Leading performance for receiver sensitivity, –34 dBm typical
- Loss of optical signal indicator
- Laser disable, LVTTL input
- LVPECL differential inputs and outputs
- Suitable for multirate applications up to 155 Mbit/s
  - Fast Ethernet (FE) compatible
- Class 1 FDA and IEC laser safety compliant
- UL 94 V-0 certified
- Compliant with FCC (Class B) and EN 55022
- Distance up to 15 km/21 km on single mode fiber (SMF)[2]

File: 1119

File: 1120

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[1] Current MSA documentation can be found at www.infineon.com/fiberoptics.

[2] IR (Intermediate Reach): up to 15 km (ITU-T G.957), up to 21 km (Telcordia GR-253).

For ordering information see next page.
LC™ is a trademark of Lucent.

Ordering Information

Part Number	Range[1]	Signal Detect	Temperature	Data Outputs if SD is Low	Collar	In-put	Out-put
Stock Products							
V23818-C18-L47	IR	LVTTL	0°C...70°C	Switched to Low	yes	AC	AC
V23818-C18-L46			−40°C...85°C				
Products on Request							
V23818-C18-L37	IR	LVPECL	0°C...70°C	Switched to Low	yes	DC	DC
V23818-C18-L36			−40°C...85°C				
V23818-C18-L45	IR	LVTTL	0°C...70°C	Switched to Low	no	AC	AC
V23818-C18-L49			−40°C...85°C				
V23818-C18-L35	IR	LVPECL	0°C...70°C	Switched to Low	no	DC	DC
V23818-C18-L39			−40°C...85°C				
V23818-C18-L436	IR	LVPECL	−40°C...85°C	Active	yes	DC	DC

[1] IR (Intermediate Reach): up to 15 km (ITU-T G.957), up to 21 km (Telcordia GR-253).
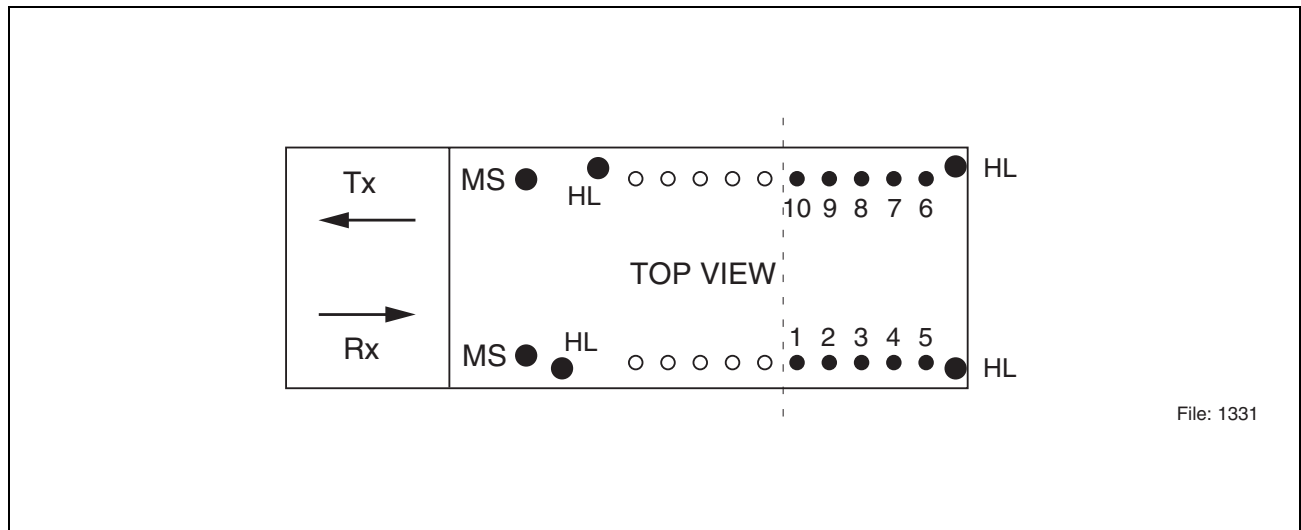
Pin Configuration

Figure 1

Pin Description

Pin No.	Symbol	Level/Logic	Description
1	V_{EEr}	Ground	Receiver signal ground
2	V_{CCr}	Power supply	Receiver power supply
3	SD	LVTTL or LVPECL output[1]	Receiver optical input level monitor
4	RD–	LVPECL output	Receiver data out bar
5	RD+	LVPECL output	Receiver data out
6	V_{CCt}	Power supply	Transmitter power supply
7	V_{EEt}	Ground	Transmitter signal ground
8	TDis	LVTTL input	Transmitter disable
9	TD+	LVPECL input	Transmitter data in
10	TD–	LVPECL input	Transmitter data in bar
MS			Mounting studs
HL			Housing leads

[1] LVPECL output active high for V23818-C18-L3x/L436.
LVTTL output active high for V23818-C18-L4x.

V_{EEr} / V_{EEt}

Connect pins 1 and 7 to signal ground.

V_{CCr} / V_{CCt}

A 3.3 V DC power supply must be applied at pins 2 and 6. A recommended power supply filter network is given in the termination scheme. Locate power supply filtering directly at the transceiver power supply pins. Proper power supply filtering is essential for good EMI performance.

TD+ / TD–

Transmitter data LVPECL level inputs. For V23818-C18-L4x terminated and AC coupled internally. For V23818-C18-L3x/L436 use termination and coupling as shown in the termination scheme.

RD– / RD+

Receiver data LVPECL level outputs. For V23818-C18-L4x biased and AC coupled internally. For V23818-C18-L3x/L436 use termination and coupling as shown in the termination scheme.

TDis

A logical LVTTL high input will disable the laser. To enable the laser, an LVTTL low input must be applied. Leave pin unconnected if feature not required.

SD

LVTTL output for V23818-C18-L4x. LVPECL output for V23818-C18-L3x/L436. A logical high output indicates normal optical input levels to the receiver. Low optical input levels at the receiver result in a low output. Signal Detect can be used to determine a definite optical link failure; break in fiber, unplugging of a connector, faulty laser source. However it is not a detection of a bad link due to data-related errors.

MS

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. The holes in the circuit board must be tied to chassis ground.

HL

Housing leads are provided for additional signal grounding. The holes in the circuit board must be included and tied to signal ground.

Description

This data sheet describes the Infineon single mode ATM transceiver, which complies with the ATM Forum's Network Compatible ATM for Local Network Applications document and ANSI's Broadband ISDN - Customer Installation Interfaces, Physical Media Dependent Specification, T1E1.2, compliant to SONET OC-3, IR-1 (Telcordia GR-253-CORE) and SDH STM-1/S-1.1 (ITU-T G.957).

This transceiver is also suitable for multirate applications. The performance at lower datarates may vary from application to application and is link dependent. Refer to Infineon Application Note 97 for more information.

ATM was developed to facilitate solutions in multimedia applications and real time transmission. The data rate is scalable, and the ATM protocol is the basis of the broadband public networks being standardized in the International Telecommunications Union (ITU), the former International Telegraph and Telephone Consultative Committee (CCITT). ATM can also be used in local private applications.

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

This transceiver operates at up to 155.520 Mbit/s from a single power supply (+3.3 V). The full differential data inputs and outputs are LVPECL compatible.

Functional Description of SFF 2x5 Pin Row Transceiver

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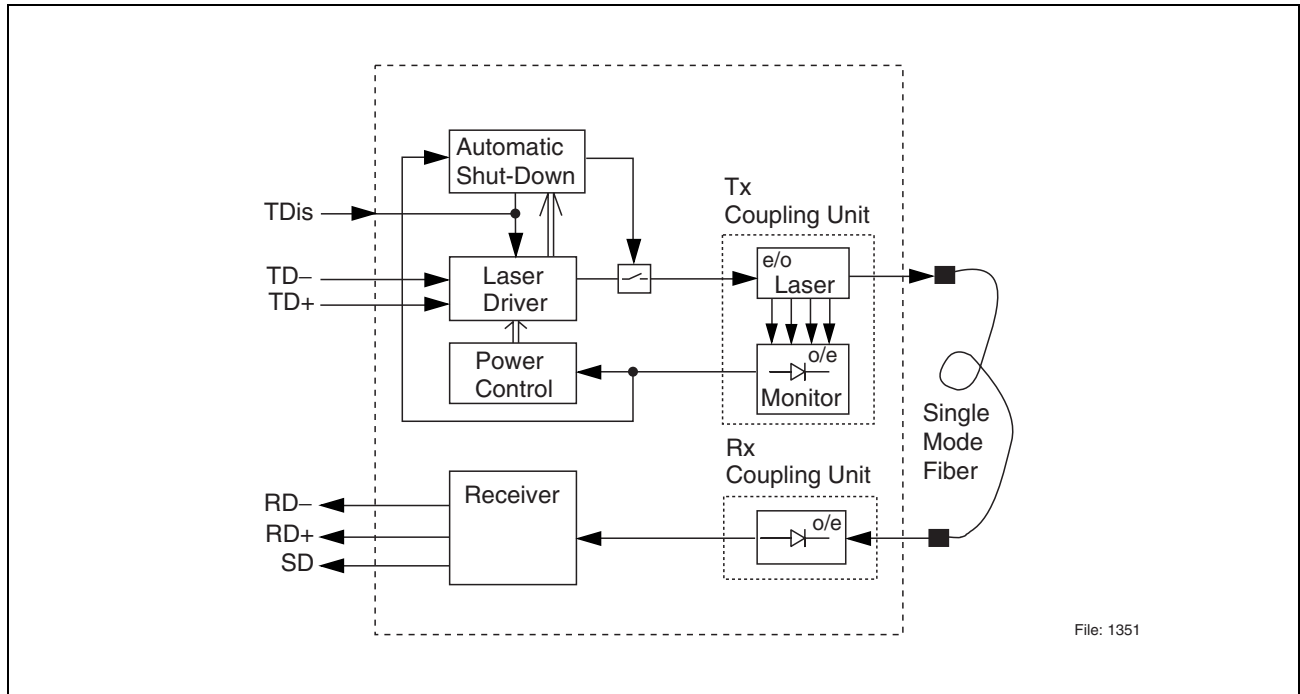

Figure 2   Functional Diagram

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

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

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.

Single fault condition is ensured by means of an integrated automatic shutdown circuit that disables the laser when it detects laser fault to guarantee the laser eye safety.

The transceiver contains a supervisory circuit to control the power supply. This circuit makes an internal reset signal whenever the supply voltage (V_{CCt}) drops below the reset threshold (V_{TH}). It keeps the reset signal active for at least 140 milliseconds after the voltage has risen above the reset threshold. During this time the laser is inactive.

A high signal on TDis enables the transmitter. If TDis is low or not connected the transmitter is not affected.

Regulatory Compliance

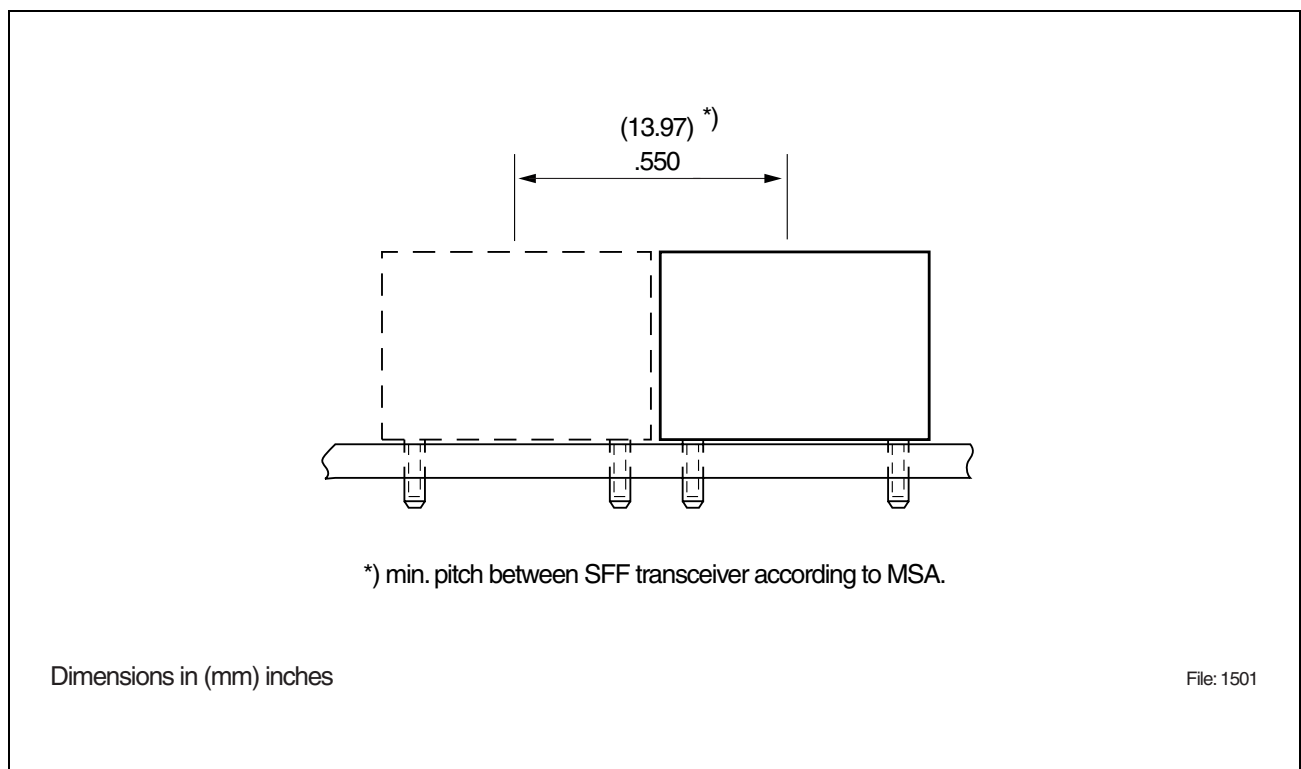| Feature	Standard	Comments
ESD: Electrostatic Discharge to the Electrical Pins	EIA/JESD22-A114-B (MIL-STD 883D Method 3015.7)	Class 1C
Immunity: Against Electrostatic Discharge (ESD) to the Duplex LC Receptacle	EN 61000-4-2 IEC 61000-4-2	Discharges ranging from ±2 kV to ±15 kV on the receptacle cause no damage to transceiver (under recommended conditions).
Immunity: Against Radio Frequency Electromagnetic Field	EN 61000-4-3 IEC 61000-4-3	With a field strength of 3 V/m, 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

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

Dimensions in (mm) inches

File: 1501

Figure 3   Transceiver Pitch

Technical Data

Absolute Maximum Ratings

Parameter	Symbol	Limit Values		Unit
		min.	**max.**	
Package Power Dissipation			0.9	W
Supply Voltage	$V_{CC}-V_{EE}$		4	V
Data Input Levels		$V_{CC}+0.5$	$V_{CC}-0.5$	V
Differential Data Input Voltage Swing	V_{ID}pk-pk		5	V
Storage Ambient Temperature		−40	85	°C
Hand Lead Soldering Temp/Time			260/10	°C/s
Wave Soldering Temp/Time			260/10	°C/s
Aqueous Wash Pressure			< 110	psi

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

Recommended Operating Conditions

Parameter	Symbol	Limit Values			Unit
		min.	**typ.**	**max.**	
Ambient Temperature[1] [3]	T_{AMB}	0		70	°C
Ambient Temperature[2] [3]		−40		85	
Power Supply Voltage	$V_{CC}-V_{EE}$	3.14	3.3	3.46	V
Transmitter					
Supply Current Tx[4]	I_{CCt}			110	mA
Data Input High Voltage DC/DC	$V_{IH}-V_{CC}$	−1165		−880	mV
Differential Data Input Voltage Swing AC/AC[5]	V_{ID}pk-pk	500		3200	mV
Data Input Low Voltage DC/DC	$V_{IL}-V_{CC}$	−1810		−1475	mV
Input Data Rise/Fall, 10% - 90%	t_R, t_F	0.4		1.3	ns
Receiver					
Supply Current Rx[4]	I_{CCr}			130	mA
Output Current	I_O			25	mA
Input Center Wavelength	λ_C	1260		1360	nm

[1] Only for V23818-C18-Lx5/Lx7.

[2] Only for V23818-C18-Lx6/Lx9/L436.

[3] Ambient operating temperature requires a 2 ms⁻¹ airflow over the device.

[4] For $V_{CC}-V_{EE}$ (min., max.). 50% duty cycle. The supply current does not include the load drive current of the receiver output. Add max. 45 mA for the three outputs. Load is 50 Ω to $V_{CC}-2$ V.

[5] V23818-C18-L4x are internally AC coupled. External coupling capacitors required for V23818-C18-L3x/L436.

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

Transmitter Electro-Optical Characteristics

Transmitter	Symbol	Limit Values			Unit
		min.	typ.	max.	
Output Power (Average)[1]	P_O	−15		−8	dBm
Center Wavelength	λ_C	1260		1360	nm
Spectral Width (FWHM)	D_l			7.7	nm
Extinction Ratio (Dynamic)	ER	8.2			dB
Output Rise Time	t_R	0.6		2.5	ns
Output Fall Time	t_F	0.6		3	ns
Reset Threshold for V_{CCt}[2]	V_{TH}		2.7		V
Power on Delay[2]	t_{RES}		30		ms
Eye Diagram[3]	ED	ITU-T G.957 mask pattern			
Jitter Generation	J_{GE}pk-pk			0.1	UI
	J_{GE}RMS			0.01	UI
T_{Dis} Assert Voltage LVTTL	V_{TDH}	2			V
T_{Dis} Deassert Voltage LVTTL	V_{TDL}			0.8	V
T_{Dis} Assert Time[4]	t_{ASS}		0.4	1	ms
T_{Dis} Deassert Time[5]	t_{DAS}		0.06	10	µs

[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}.

[3] Transmitter meets ANSI T1E1.2, SONET OC-3, and ITU-T G.957 mask patterns.

[4] T_{Dis} assertion to laser shutdown.

[5] T_{Dis} reassertion to laser startup.

Jitter

The transceiver is specified to meet the SONET/SDH Jitter performance as outlined in ITU-T G.958 and Telcordia GR-253.

Jitter Generation is defined as the amount of jitter that is generated by the transceiver. The Jitter Generation specifications are referenced to the optical OC-3 signals. If no or minimum jitter is applied to the electrical inputs of the transmitter, then Jitter Generation can simply be defined as the amount of jitter on the Tx optical output. The SONET specifications for Jitter Generation are 0.01 UI RMS, maximum and 0.1 UI pk-pk, maximum. For SDH, 10 mUI RMS, maximum. Both are measured with a 12 kHz - 1.3 MHz filter in line. A UI is a Unit Interval, which is equivalent to one bit slot. At OC-3, the bit slot is 6.4 ns, so the Jitter Generation specification translates to 64 ps RMS, max. and 640 ps pk-pk, max.

Receiver Electro-Optical Characteristics

Receiver	Symbol	Limit Values			Unit
		min.	typ.	max.	
Sensitivity (Average Power)[1]	P_{IN}		−34	−29	dBm
Saturation (Average Power)	P_{SAT}	−8			dBm
Signal Detect Assert Level[2]	P_{SDA}			−29	dBm
Signal Detect Deassert Level[3]	P_{SDD}	−45			dBm
Signal Detect Hysteresis	$P_{SDA}-P_{SDD}$		3		dB
Signal Detect Assert Time	t_{ASS}			100	µs
Signal Detect Deassert Time	t_{DAS}			350	µs
Data Output High Voltage DC/DC[4]	$V_{OH}-V_{CC}$	−1110		−650	mV
Differential Data Output Voltage Swing AC/AC	V_{OD}pk-pk	1000		2000	mV
Data Output Low Voltage DC/DC[4]	$V_{OL}-V_{CC}$	−1800		−1300	mV
Signal Detect Output High Voltage LVPECL[5] [6]	$V_{SDH}-V_{EE}$	V_{CC} −1200		V_{CC} −820	mV
Signal Detect Output Low Voltage LVPECL[5] [6]	$V_{SDL}-V_{EE}$	V_{CC} −1900		V_{CC} −1580	mV
Signal Detect Output High Voltage LVTTL[5] [7]	V_{SDH}	2.4			V
Signal Detect Output Low Voltage LVTTL[5] [7]	V_{SDL}			0.5	V
Output Data Rise/Fall Time, 20% - 80%	t_R, t_F			1	ns
Output SD Rise/Fall Time	t_R, t_F			40	ns

[1] Minimum average optical power at which the BER is less than 1×10^{-10}. Measured with a $2^{23}-1$ NRZ PRBS. Worst case receiver sensitivity at 25°C is −31 dBm (beginning of life).

[2] An increase in optical power of data signal 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 of data signal 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] Measured under DC conditions at 25°C. For dynamic measurements a tolerance of 50 mV should be added.

[6] Only for V23818-C18-L3x/L436.

[7] Only for V23818-C18-L4x.

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.

Attention: 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

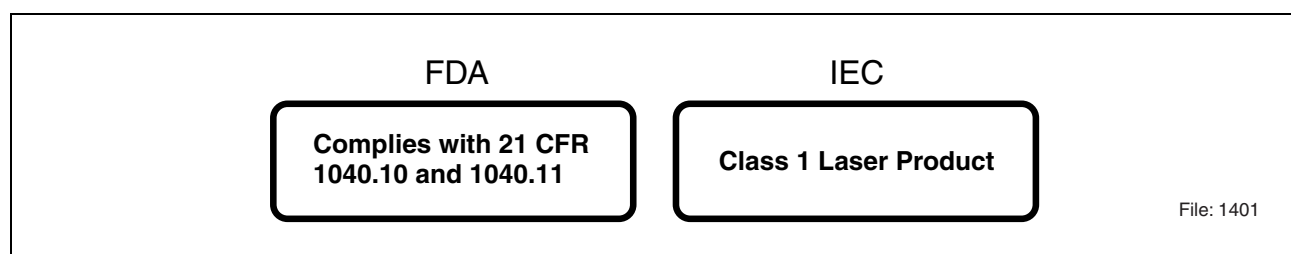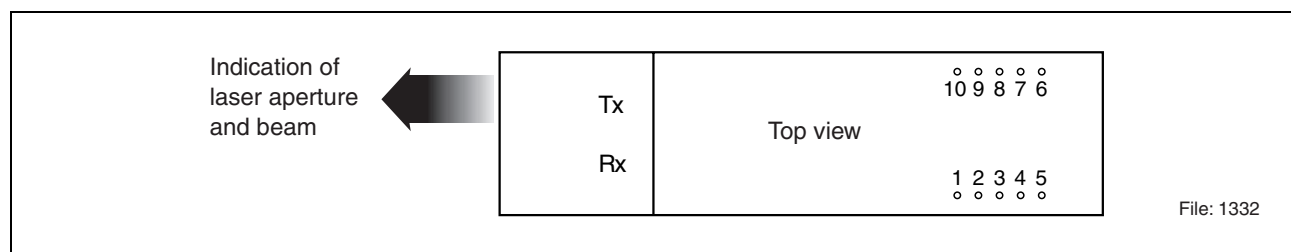| Wavelength	1300 nm
Total Output Power (as defined by IEC: 7 mm aperture at 14 mm distance)	2 mW
Total Output Power (as defined by FDA: 7 mm aperture at 20 cm distance)	180 µW
Beam Divergence	4°

Figure 4   Required Labels

Figure 5   Laser Emission

EMI-Recommendations

To avoid electromagnetic radiation exceeding the required limits please take note of the following recommendations.

When high speed components are found on a PCB (multiplexers, clock recoveries etc.) any opening of the chassis may produce radiation also at chassis slots other than that of the device itself. 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, vias should be avoided. A terminating 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 a thevenin equivalent 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.

In certain cases signal GND is the most harmful source of radiation. Connecting chassis GND and signal GND at the plate/ bezel/ chassis rear e.g. by means of a fiber optic transceiver may result in a large 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 planned, it is strongly recommended to provide a proper contact between signal GND and chassis GND at every location where possible. This concept is designed to avoid hotspots. Hotspots are places of highest radiation which could be generated if only a few connections between signal and chassis GND exist. Compensation currents would concentrate at these connections, causing radiation.

By use of Gigabit switching components in a design, the return path of the RF current must also be considered. Thus a split GND plane of Tx and Rx portion may result in severe EMI problems.

A recommendation is to connect the housing leads to signal GND. However, in certain applications it may improve EMI performance by connecting them to chassis GND.

The cutout should be sized so that all contact springs make good contact with the face plate.

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 scenario even the smallest PCBs may have unexpected resonances.

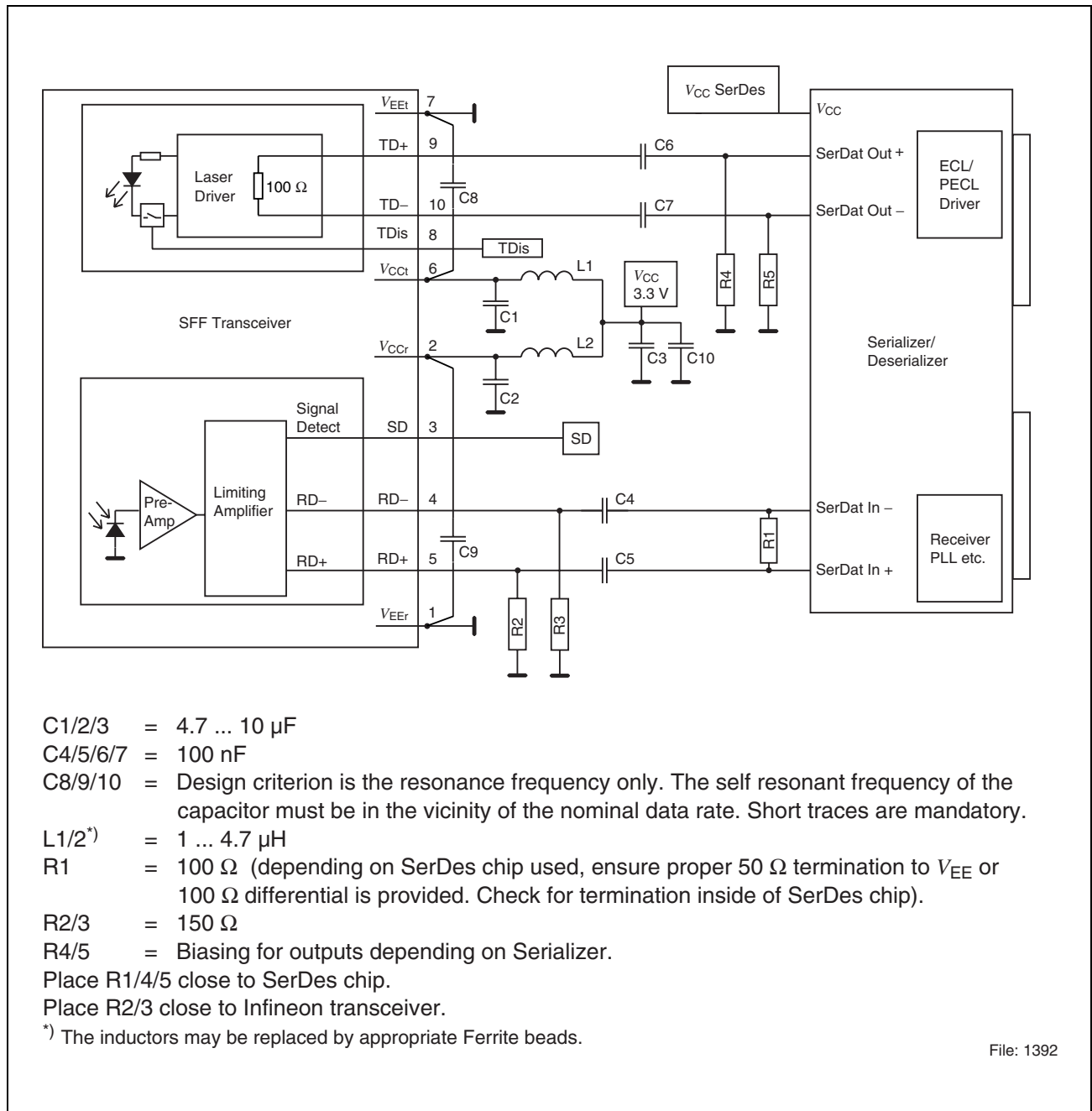## Recommended Termination Schemes

2x5 DC/DC Transceiver

C1/2/3 = 4.7 ... 10 µF
C4/5/6/7 = 100 nF
C8/9/10 = Design criterion is the resonance frequency only. The self resonant frequency of the capacitor must be in the vicinity of the nominal data rate. Short traces are mandatory.
L1/2[*)] = 1 ... 4.7 µH
R1 = 100 Ω (depending on SerDes chip used, ensure proper 50 Ω termination to V_{EE} or 100 Ω differential is provided. Check for termination inside of SerDes chip).
R2/3 = 150 Ω
R4/5 = Biasing for outputs depending on Serializer.
Place R1/4/5 close to SerDes chip.
Place R2/3 close to Infineon transceiver.
[*)] The inductors may be replaced by appropriate Ferrite beads.

File: 1392

Figure 6

2x5 AC/AC Transceiver

C1/2/3 = 4.7 ... 10 µF
C4/5/6 = Design criterion is the resonance frequency only. The self resonant frequency of the capacitor must be in the vicinity of the nominal data rate. Short traces are mandatory.
L1/2[*)] = 1 ... 4.7 µH
R1/2/3/4 = Depends on SerDes chip used, ensure proper 50 Ω termination to V_{EE} or 100 Ω differential is provided. Check for termination inside of SerDes chip.
R5/6 = Biasing (depends on SerDes chip).
Place R1/2/3/4/5/6 close to SerDes chip.
[*)] The inductors may be replaced by appropriate Ferrite beads.

File: 1393

Figure 7

Package Outlines

Dimensions in mm [inches]

File: 1212

Figure 8

V23818-C18-Lxx/L4xx

Revision History:	2003-06-06	DS1
Previous Version:	2002-01-01	

Page	Subjects (major changes since last revision)
	Document completely revised; V23818-C18-L79 deleted, V23818-C18-L7xx separated

For questions on technology, delivery and prices please contact the Infineon Technologies Offices in Germany or the Infineon Technologies Companies and Representatives worldwide: see our webpage at http://www.infineon.com.