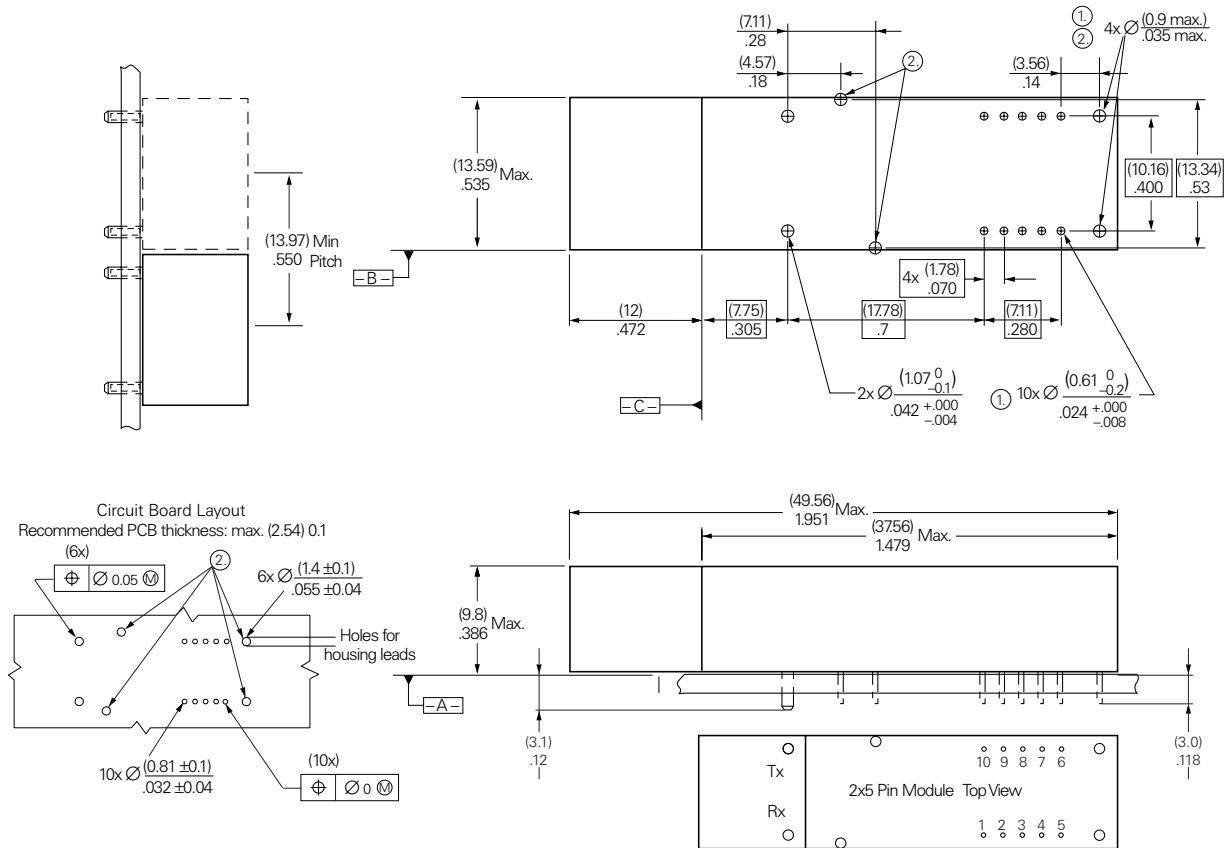


Dimensions in (mm) inches



① Toleranced to accommodate round or rectangular leads

② 4 optional package grounding tabs

10 pin module requires only 12 PCB holes.

## FEATURES

- Compliant with all major standards
- Small Form Factor transceiver
- RJ-45 style VF-45™ connector system
- Half the size of SC Duplex 1x9 transceiver
- Single power supply (3.3 V)
- Extremely low power consumption < 0.7 W
- PECL differential inputs and outputs
- System optimized for 62.5/50 μm graded index fiber
- Multisource footprint
- Small footprint for high channel density
- UL-94 V-0 certified
- ESD Class 2 per MIL-STD 883 Method 3015
- Voted as SG-connector by FC-Standard
- Compliant with FCC (Class B) and EN 55022
- For distances of up to 2 km on multimode fiber

## APPLICATIONS

- **Fiber-to-the-desktop**
- **Ethernet, Fast Ethernet, FDDI , ATM, SONET**
- **Switches/bridges/routers/server**
- **Local area networks**
- **High speed computer links**
- **Switching system**

Volition™ is a trademark of 3M

VF-45™ is a trademark of 3M

## Absolute Maximum Ratings

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

Supply Voltage ( $V_{CC}-V_{EE}$ ) ..... -0.5 V to 4.5 V  
Data Input Levels (PECL) ( $V_{IN}$ ) .....  $V_{EE}-V_{CC}$   
Differential Data Input Voltage ..... 3 V  
Operating Ambient Temperature ( $T_{AMB}$ ) ..... 0°C to 70°C  
Storage Ambient Temperature  $T_{STG}$  ..... -40°C to 85°C  
Humidity/Temperature Test Condition ( $R_H$ ) ..... 85%/85°C  
Soldering Conditions, Temp/Time ( $T_{SOLD}/t_{SOLD}$ )  
(MIL-STD 883C, Method 2003) ..... 270°C/10 s  
ESD Resistance (all pins to  $V_{EE}$ , human body) ..... 1.5 kV  
Output Current ( $I_O$ ) ..... 50 mA

## DESCRIPTION

The Siemens Ethernet/Fast Ethernet/FDDI/ATM transceiver — part of Siemens Small Form Factor transceiver family is fully compliant with the Asynchronous Transfer Mode (ATM) OC-3 standard, the Fiber Distributed Data Interface (FDDI) Low Cost Fiber Physical Layer Medium Dependent (LCF-PMD) draft standard<sup>(1)</sup>, and the FDDI PMD standard<sup>(2)</sup>, and the SFF MSA.

This transceiver supports the innovative Volition 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 SG connector. The Small Form Factor is specially developed for distances of up to 2 km.

These transceivers also support 10 Base Fx 1300 nm with DC-free balanced coding (Manchester, 8B/10B).

Fast Ethernet was developed because of the higher bandwidth requirement in local area networking. It is based on the proven effectiveness of millions of installed Ethernet systems.

ATM was developed because of the need for multimedia applications, including 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 Telegraph and Telephone Consultative Committee (CCITT). ATM can also be used in local private applications.

FDDI is a Dual Token Ring standard developed in the U.S. by the Accredited National Standards Committee (ANSC) X3T9, within the Technical Committee X3T9.5. It is applied to the local area networks of stations, transferring data at 100 Mbit/s with a 125 MBd transmission rate.

The inputs/outputs are PECL compatible and the unit operates from a 3.3 V power supply. As an option, the data output stages can be switched to static levels during absence of light, as indicated by the Signal Detect function. It can be directly interfaced with available chipsets.

## Notes

1. FDDI Token Ring, Low Cost Fiber Physical Layer Medium Dependent (LCF-PMD) ANSI X3T9.5 / 92 LCF-PMD / Proposed Rev. 1.3, September 1, 1992. American National Standard.
2. FDDI Token Ring, Physical Layer Medium Dependent (PMD) ANSI X3.166-1990 American National Standard. ISO/IEC 9314-3: 1990.

## 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 |
|---------------------------------------|-----------------|-------|------|-------|-------|
| Ambient Temperature <sup>(1)</sup>    | $T_{AMB}$       | 0     |      | 70    | °C    |
| Power Supply Voltage <sup>(1)</sup>   | $V_{CC}-V_{EE}$ | 3     | 3.3  | 3.6   | V     |
| Supply Current <sup>(2)</sup>         | $I_{CC}$        |       |      | 230   | mA    |
| <b>Transmitter</b>                    |                 |       |      |       |       |
| Data Input High Voltage               | $V_{IH}-V_{CC}$ | -1165 |      | -880  | mV    |
| Data Input Low Voltage                | $V_{IL}-V_{CC}$ | -1810 |      | -1475 |       |
| Threshold Voltage                     | $V_{BB}-V_{CC}$ | -1380 |      | -1260 |       |
| Input Data Rise/Fall, 20%–80%         | $t_R, t_F$      | 0.4   |      | 1.3   | ns    |
| Data High Time <sup>(3)</sup>         | $t_{on}$        |       |      | 1000  |       |
| <b>Receiver</b>                       |                 |       |      |       |       |
| Output Current                        | $I_O$           |       |      | 25    | mA    |
| Input Duty Cycle Distortion           | $t_{DCD}$       |       |      | 1.0   | ns    |
| Input Data Dependent Jitter           | $t_{DDJ}$       |       |      | 0.76  |       |
| Input Random Jitter                   | $t_{RJ}$        |       |      |       |       |
| Input Center Wavelength               | $I_C$           | 1260  |      | 1380  | nm    |
| Electrical Output Load <sup>(4)</sup> | $R_L$           |       | 50   |       | W     |

## Notes

1. Max. power supply voltage can not be used at max. temperature range.
2. For  $V_{CC}-V_{EE}$  (min., max.). 50% duty cycle. The supply current ( $I_{CC2}+I_{CC3}$ ) does not include the load drive current ( $I_{CC1}$ ). Add max. 45 mA for the three outputs. Load is 50  $\Omega$  into  $V_{CC}-2V$ .
3. To maintain good LED reliability, the device should not be held in the ON state for more than the specified time. Normal operation should be done with 50% duty cycle.
4. To achieve proper PECL output levels the 50  $\Omega$  termination should be done to  $V_{CC}-2V$ . For correct termination see the application notes.

## Transmitter Electro-Optical Characteristics

| Transmitter  | Symbol                          | Min. | Typ. | Max. | Units |
|--|---------------------------------|------|------|------|-------|
| Data Rate  | DR                              |      |      | 160  | MBaud |
| Launched Power (Average) into 62.5 $\mu$ m Fiber <sup>(1, 2)</sup> | P <sub>O</sub>                  | -20  | -16  | -14  | dBm   |
| Center Wavelength <sup>(2, 3)</sup>                                | $\lambda_C$                     | 1270 |      | 1360 | nm    |
| Spectral Width (FWHM) <sup>(2, 4)</sup>                            | D <sub>I</sub>                  |      |      | 170  |       |
| Output Rise/Fall Time, 10%–90% <sup>(2, 5)</sup>                   | t <sub>R</sub> , t <sub>F</sub> | 0.6  |      | 2.5  | ns    |
| Temperature Coefficient of Optical Output Power                    | TC <sub>p</sub>                 |      |      | 0.03 | dB/°C |
| Extinction Ratio (Dynamic) <sup>(2, 6)</sup>                       | ER                              |      |      | 10   | %     |
| Optical Power Low <sup>(7)</sup>                                   | P <sub>TD</sub>                 |      |      | -45  | dBm   |
| Overshoot  | OS                              |      |      | 10   | %     |
| Duty Cycle Distortion <sup>(8, 9)</sup>                            | t <sub>DCD</sub>                |      |      | 0.6  | ns    |
| Data Dependent Jitter <sup>(8, 10)</sup>                           | t <sub>DDJ</sub>                |      |      | 0.3  |       |
| Random Jitter <sup>(8, 11)</sup>                                   | t <sub>RJ</sub>                 |      |      | 0.6  |       |

### Notes

1. Measured at the end of 5 meters of 62.5/125/0.275 graded index fiber using calibrated power meter and a precision test ferrule. Cladding modes are removed. Values valid for EOL and worst-case temperature.
2. The input data pattern is a 12.5 MHz square wave pattern.
3. Center wavelength is defined as the midpoint between the two 50% levels of the optical spectrum of the LED.
4. Spectral width (full width, half max) is defined as the difference between 50% levels of the optical spectrum of the LED.
5. 10% to 90% levels. Measured using the 12.5 MHz square wave pattern with an optoelectronic measurement system (detector and oscilloscope) having 3 dB bandwidth ranging from less than 0.1 MHz to more than 750 MHz.
6. Extinction Ratio is defined as PL/PH x 100%. Measurement system as in Note 5.
7. Optical Power Low is the output power level when a steady state low data pattern (FDDI Quiet Line state) is used to drive the transmitter. Value valid <1 ms after input low.
8. Test method as for FDDI-PMD. Jitter values are peak-to-peak.
9. Duty Cycle Distortion is defined as 0.5 [(width of wider state) minus (width of narrower state)]. It is measured with stream of Idle Symbols (62.5 MHz square wave).
10. Measured with the same pattern as for FDDI-PMD.
11. Measured with the Halt Line state (12.5 MHz square wave).

## Receiver Electro-Optical Characteristics

| Receiver  | Symbol                             | Min.  | Typ.  | Max.  | Units |
|---|------------------------------------|-------|-------|-------|-------|
| Data Rate <sup>(1)</sup>                          | DR                                 | 10    |       | 160   | MBaud |
| Sensitivity (Average Power) <sup>(1)</sup>        | P <sub>IN</sub>                    |       | -33   | -31   | dBm   |
| Sensitivity (Average Power) Center <sup>(2)</sup> |                                    |       | -35.5 |       |       |
| Saturation (Average Power) <sup>(2)</sup>         | P <sub>SAT</sub>                   | -14   | -11   |       |       |
| Duty Cycle Distortion <sup>(3, 4)</sup>           | t <sub>DCD</sub>                   |       |       | 1     | ns    |
| Deterministic Jitter <sup>(4, 5)</sup>            | t <sub>DJ</sub>                    |       |       | 1     |       |
| Random Jitter <sup>(4, 6)</sup>                   | t <sub>RJ</sub>                    |       |       |       |       |
| Signal Detect Assert Level <sup>(7)</sup>         | P <sub>SDA</sub>                   | -42.5 |       | -30   | dBm   |
| Signal Detect Deassert Level <sup>(8)</sup>       | P <sub>SDD</sub>                   | -45   |       | -31.5 |       |
| Signal Detect Hysteresis                          | P <sub>SDA</sub> –P <sub>SDD</sub> | 1.5   |       |       | dB    |
| Output Low Voltage <sup>(9)</sup>                 | V <sub>OL</sub> –V <sub>CC</sub>   | -1810 |       | -1620 | mV    |
| Output High Voltage <sup>(9)</sup>                | V <sub>OH</sub> –V <sub>CC</sub>   | -1025 |       | -880  |       |
| Output Data Rise/Fall Time, 20%–80%               | t <sub>R</sub> , t <sub>F</sub>    |       |       | 1.3   | ns    |
| Output SD Rise/Fall Time, 20%–80%                 |                                    |       |       | 40    |       |

### Notes

1. For a bit error rate (BER) of less than 1x10<sup>-12</sup> over a receiver eye opening of least 1.5 ns. Measured with a 2<sup>23</sup>-1 PRBS at 155 MBd.
2. For a BER of less than 1x10<sup>-12</sup>. Measured in the center of the eye opening with a 2<sup>23</sup>-1 PRBS at 155 MBd.
3. Measured at an average optical power level of -20 dBm with a 62.5 MHz square wave.
4. All jitter values are peak-to-peak. RX output jitter requirements are not considered in the ATM standard draft. In general the same requirements as for FDDI are met.
5. Measured at an average optical power level of -20 dBm.
6. Measured at -29 dBm average power.
7. An increase in optical power through the specified level will cause the SIGNAL detect output to switch from a Low state to a High state.
8. A decrease in optical power through the specified level will cause the SIGNAL detect output to switch from a High state to a Low state.
9. PECL compatible. Load is 50  $\Omega$  into V<sub>CC</sub> -2 V. Measured under DC conditions. For dynamic measurements a tolerance of 50 mV should be added.

## Regulatory Compliance

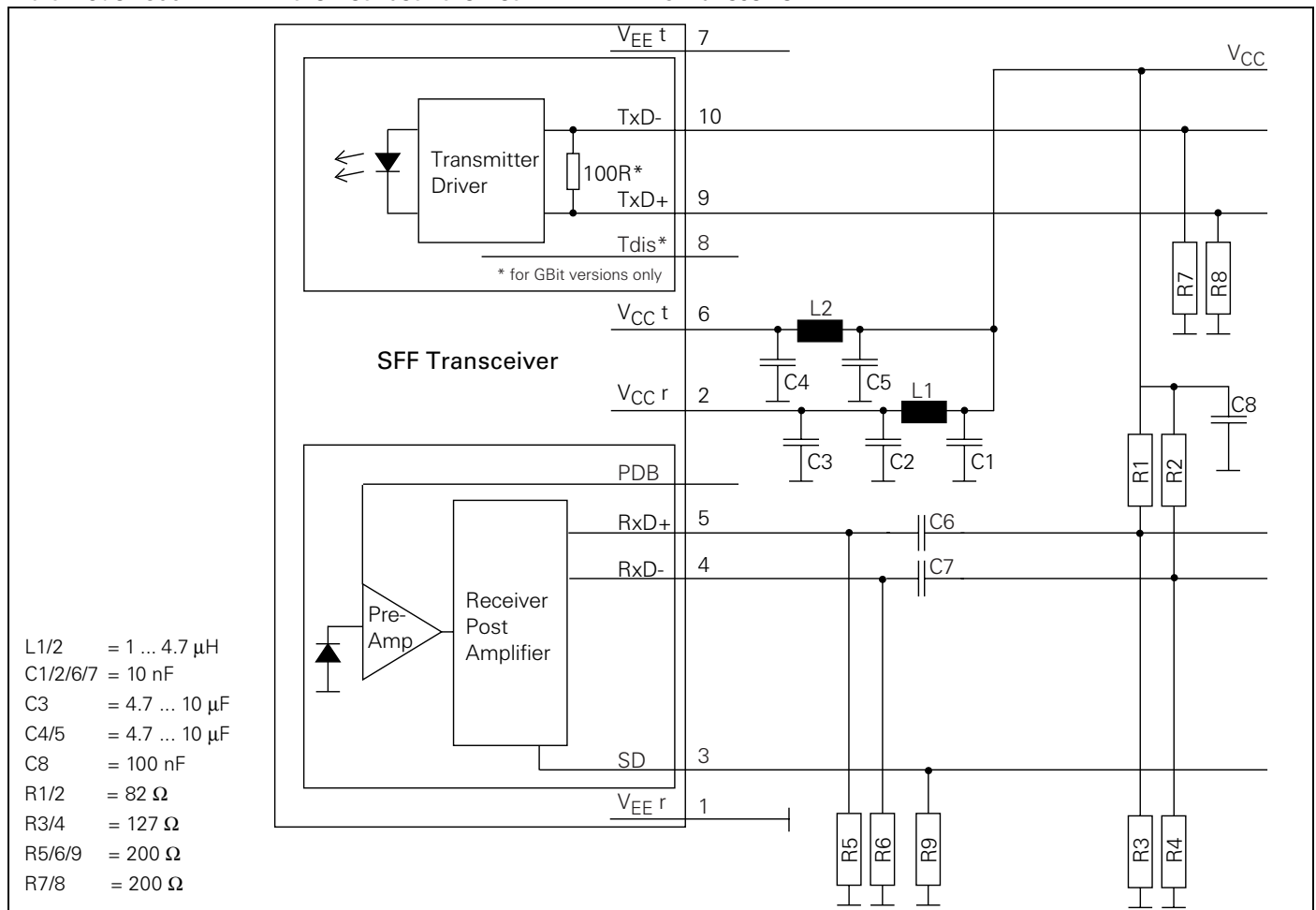
| Feature  | Standard                              | Comments  |
|--|---------------------------------------|---|
| Electromagnetic Interference (EMI)                 | FCC Class B EN 55022 Class B CISPR 22 | Noise frequency range:30 MHz to 1 GHz   |
| Immunity:<br>Electrostatic Discharge               | EN 61000-4-2<br>IEC 1000-4-2          | Discharges of $\pm 1.5\text{kV}$ with an air discharge probe on the receptacle cause no damage. |
| Immunity:<br>Radio Frequency Electromagnetic Field | EN 61000-4-3<br>IEC 1000-4-3          | With a field strength of 10 V/m rms, noise frequency ranges from 10 MHz to 1 GHz                |
| Eye Safety   | IEC 825-1                             | Class 1   |

## Pin Description

| Pin Name                       | Level/Logic      | Pin# | Description   |
|--------------------------------|------------------|------|---|
| R <sub>x</sub> V <sub>EE</sub> | Rx Ground        | 1    | Negative power supply, normally ground                      |
| R <sub>x</sub> V <sub>CC</sub> | Rx +3.3 V        | 2    | Positive power supply, +3.3 V                               |
| RxSD                           | Rx Signal Detect | 3    | High level on this output shows there is an optical signal. |
| RDn                            | Rx Output Data   | 4    | Inverted receiver output data                               |
| RD                             |                  | 5    | Receiver output data  |
| T <sub>x</sub> V <sub>CC</sub> | Tx +3.3 V        | 6    | Positive power supply, +3.3 V                               |
| T <sub>x</sub> V <sub>EE</sub> | Tx Ground        | 7    | Negative power supply, normally ground                      |
| NC                             |                  | 8    | Not Connected, Transmit disable                             |
| TxD                            | Tx Input Data    | 9    | Transmitter input data                                      |
| TxDn                           |                  | 10   | Inverted transmitter input data                             |

## APPLICATION NOTE

### Multimode 1300 nm LED Ethernet/Fast Ethernet/FDDI/ATM 2x5 Transceiver



## APPLICATION NOTE FOR MULTIMODE 1300 NM LED TRANSCEIVER

### Solutions for connecting a Siemens 3.3 V Fiber Optic Transceiver to a 5.0 V Framer-/Phy-Device.

Figure 1. Common GND

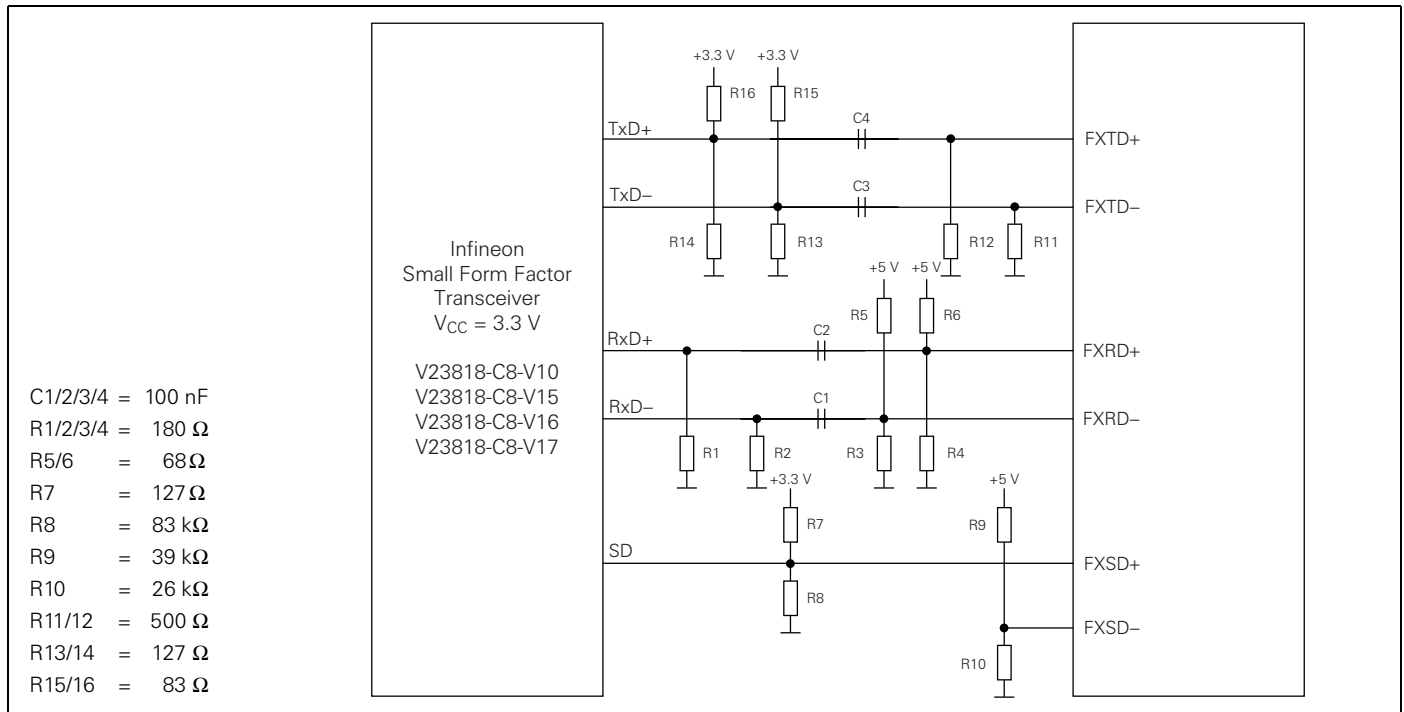
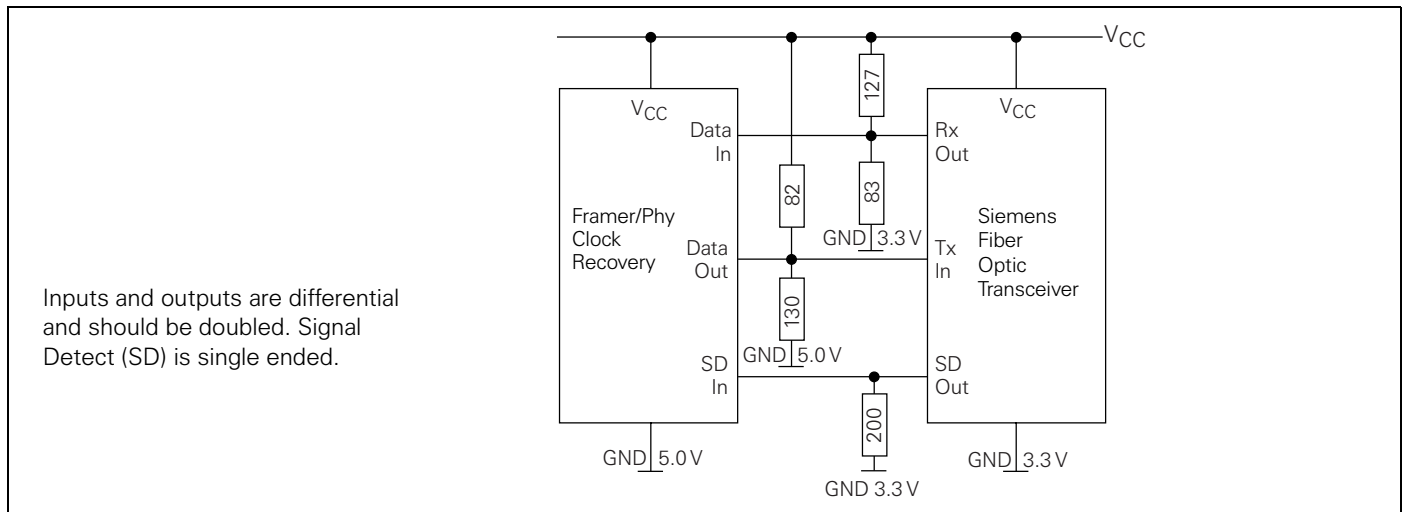


Figure 2. Common  $V_{CC}$



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