# CS13F-24A-3S-Tx-Cx
## 1.25Gbps 1310nm SMF 10km 1x9 Optical Transceiver

**Data Sheet**

### DESCRIPTION

The CS13F-24A-3S-Tx-Cx duplex 1x9 optical transceivers are high performance, cost effective optical transceiver modules for serial optical data communications application specified for a data rate of 1.25Gb/s. The 1x9 transceiver module provides 10km transmission distance over single mode fiber at nominal wavelength of 1310nm. The optical transceiver is RoHS compliant.

### FEATURES

- Compliant with IEEE 802.3 Gigabit Ethernet standard
- Industry standard 1x9 footprint
- SC duplex connector
- Single power supply 3.3V
- Differential inputs and outputs
- Compatible with solder and aqueous wash processes
- Class 1 laser product compliant with EN 60825-1
- Up to 10km over single mode fiber

### APPLICATIONS

- 1000Base-LX

### ORDERING INFORMATION

| PART NUMBER | INPUT/OUTPUT | SIGNAL DETECT | TEMPERATURE | CLIPPER/SHIELD |
|---|---|---|---|---|
| CS13F-24A-3S-TC-C | AC/AC | LVTTL | 0ºC to 70ºC | No Shield |
| CS13F-24A-3S-TC-CB | AC/AC | LVTTL | 0ºC to 70ºC | Backward Clipper |
| CS13F-24A-3S-TC-CF | AC/AC | LVTTL | 0ºC to 70ºC | Forward Clipper |
| CS13F-24A-3S-TI-C | AC/AC | LVTTL | -40ºC to 85ºC | No Shield |
| CS13F-24A-3S-TI-CB | AC/AC | LVTTL | -40ºC to 85ºC | Backward Clipper |
| CS13F-24A-3S-TI-CF | AC/AC | LVTTL | -40ºC to 85ºC | Forward Clipper |

### ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | MIN | MAX | UNIT | NOTES |
|---|---|---|---|---|---|
| Storage Temperature | $T_S$ | -40 | 85 | °C | |
| Supply Voltage | $V_{CC}$ | -0.5 | 4.0 | V | |
| Input Voltage | $V_{IN}$ | -0.5 | $V_{CC}$ | V | |
| Soldering Temperature | $T_{SOLD}$ | - | 260 | °C | 10 seconds on leads |

### OPERATING ENVIRONMENT

| PARAMETER | SYMBOL | MIN | MAX | UNIT |
|---|---|---|---|---|
| Ambient Operating Temperature | $T_{AMB}$ | 0 | 70 | °C |
| | | -40 | 85 | |
| Supply Voltage | $V_{CC}$ | 3.1 | 3.5 | V |
| Supply Current | Tx+Rx | - | 240 | mA |

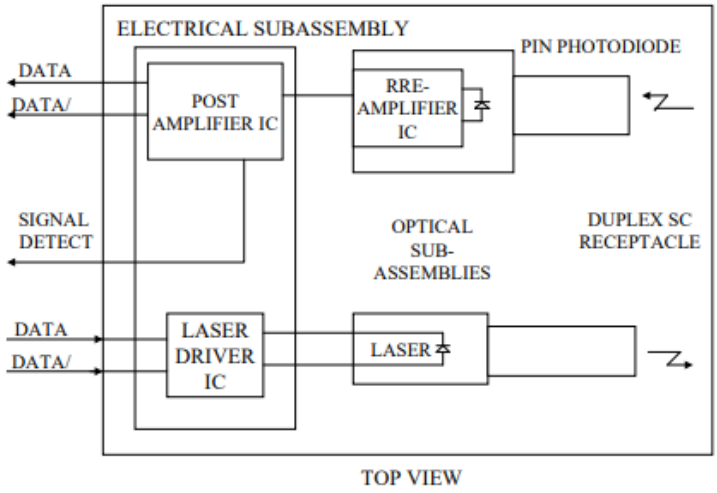
### TRANSMITTER ELECTRO-OPTICAL CHARACTERISTICS

| PARAMETER | SYMBOL | MIN | TYP. | MAX | UNIT | NOTES |
|---|---|---|---|---|---|---|
| Output Optical Power 9/125um fiber | $P_{out}$ | -9.5 | - | -3 | dBm | Average |
| Extinction Ratio | ER | 9 | - | - | dB | |
| Center Wavelength | $\lambda_C$ | 1270 | 1310 | 1355 | nm | |
| Spectral Width (RMS) | $\Delta\lambda$ | - | - | 2.5 | nm | |
| Rise/Fall Time (20~80%) | $T_{r,f}$ | - | - | 260 | ps | |
| Total Jitter | TJ | - | - | 227 | ps | |
| Output Eye | Compliant with IEEE802.3z | | | | | |
| Transmitter Data Input Differential Voltage | $V_{DIFF}$ | 0.3 | - | 2.0 | V | |

### RECEIVER ELECTRO-OPTICAL CHARACTERISTICS

| PARAMETER | SYMBOL | MIN | TYP. | MAX | UNIT | NOTES |
|---|---|---|---|---|---|---|
| Optical Input Power-Maximum | $P_{IN}$ | -3 | - | - | dBm | BER<$10^{-12}$ |
| Optical Input Power-Minimum (Sensitivity) | $P_{IN}$ | - | - | -20 | dBm | BER<$10^{-12}$ |
| Operating Center Wavelength | $\lambda_C$ | 1260 | - | 1610 | nm | |
| Optical Return Loss | ORL | 12 | - | - | dB | |
| Signal Detect-Asserted | $P_A$ | - | - | -20 | dBm | |
| Signal Detect-Deasserted | $P_D$ | -35 | - | - | dBm | |
| Signal Detect-Hysteresis | $P_A$-$P_D$ | 1.0 | - | - | dB | |
| Stressed Receiver Sensitivity | | - | - | -14.4 | dBm | |
| Signal Detect Output Voltage-High | $V_{OH}$ | $V_{CC}$-0.8 | - | $V_{CC}$ | V | |
| Signal Detect Output Voltage-Low | $V_{OL}$ | 0 | - | 0.5 | V | |
| Data Output Rise, Fall time (20~80%) | $T_{r,f}$ | - | - | 0.35 | ns | |
| Data Output Differential Voltage | $V_{DIFF}$ | 0.6 | - | 1.2 | V | |

**BLOCK DIAGRAM OF TRANSCEIVER**



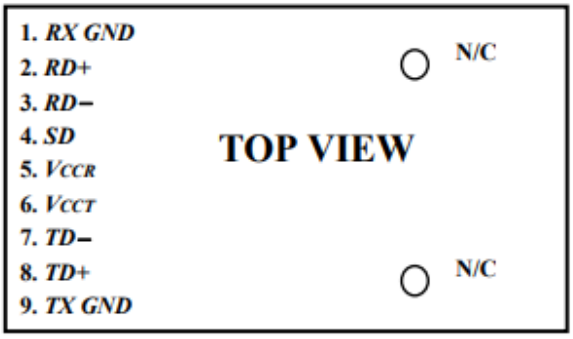

**Transmitter Section** - The transmitter section consists of a 1310 nm laser in an eye safe optical subassembly (OSA) which mates to the fiber cable. The laser OSA is driven by a LD driver IC which converts differential input logic signals into an analog laser driving current.

**Receiver Section** - The receiver utilizes a detector integrated with a trans-impedance preamplifier in an OSA. This OSA is connected to a circuit providing post-amplification quantization, and optical signal detection.

**Receiver Signal Detect** - Signal Detect is a basic fiber failure indicator. This is a single-ended LVTTL output. As the input optical power is decreased, Signal Detect will switch from high to low (deassert point) somewhere between sensitivity and the no light input level. As the input optical power is increased from very low levels, Signal Detect will switch back from low to high (assert point).

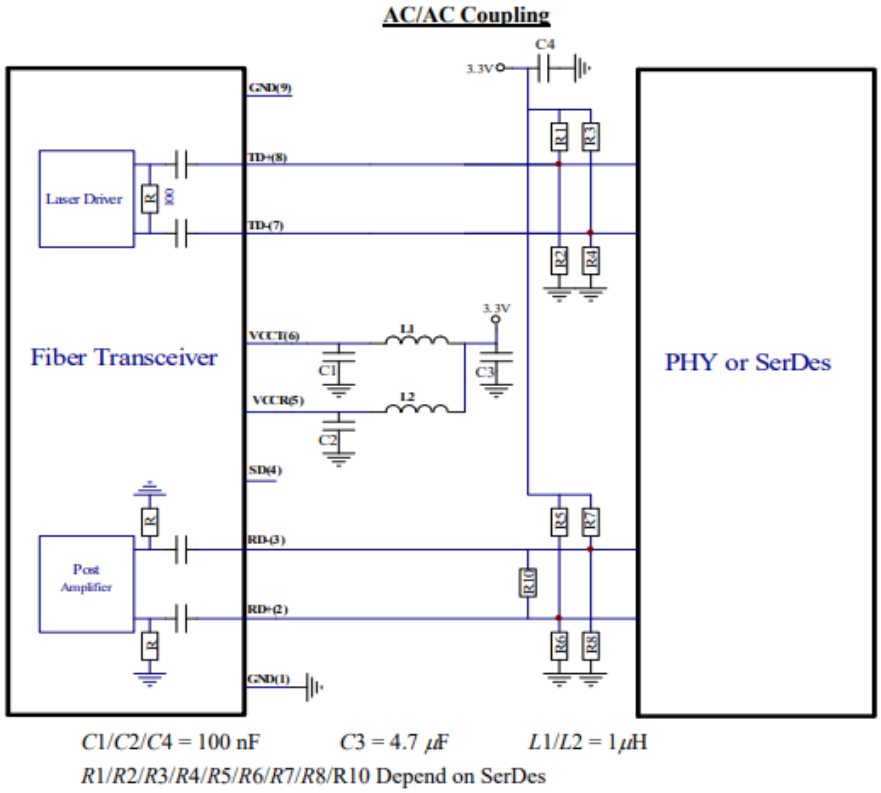
## CONNECTION DIAGRAM

Pin-Out




| PIN | SYMBOL | DESCRIPTION |
|---|---|---|
| 1 | *RX GND* | Receiver Signal Ground.<br>Directly connect this pin to the receiver ground plane. |
| 2 | *RD+* | Receiver Data Output<br>Internally ac coupled. Terminate this differential data output with a 50Ω line and a 50Ω load at the follow-on device (See recommended circuit schematic) |
| 3 | *RD–* | Receiver Data Output-Bar<br>Internally ac coupled. Terminate this differential data output with a 50Ω line and a 50Ω load at the follow-on device (See recommended circuit schematic) |
| 4 | *SD* | Signal Detect.<br>Normal optical input levels to the receiver result in a logic "1" output, $V_{OH}$, asserted. Low input optical levels to the receiver result in a fault condition indicated by a logic "0" output $V_{OL}$, deasserted Signal Detect is a LVTTL output. |
| 5 | $V_{CCR}$ | Receiver Power Supply.<br>Provide +3.3 Vdc via the recommended receiver power supply filter circuit. Locate the power supply filter circuit as close as possible to the $V_{CCR}$ pin. |
| 6 | $V_{CCT}$ | Transmitter Power Supply.<br>Provide +3.3 Vdc via the recommended transmitter power supply filter circuit. Locate the power supply filter circuit as close as possible to the $V_{CCT}$ pin. |
| 7 | *TD–* | Transmitter Data In-Bar.<br>Internally ac coupled. The input stage is internally biased and 50Ω terminated. (See recommended circuit schematic) |
| 8 | *TD+* | Transmitter Data In.<br>Internally ac coupled. The input stage is internally biased and 50Ω terminated. (See recommended circuit schematic) |
| 9 | *TX GND* | Transmitter Signal Ground.<br>Directly connect this pin to the transmitter signal ground plane. Directly connect this pin to the transmitter ground plane. |

**RECOMMENDED CIRCUIT SCHEMATIC**




In order to get proper functionality, a recommended circuit is provided in above recommended circuit schematic. When designing the circuit interface, there are a few fundamental guidelines to follow.

(1) The differential data lines should be treated as 50 Ω Micro strip or strip line transmission lines. This will help to minimize the parasitic inductance and capacitance effects. Locate termination at the received signal end of the transmission line. The length of these lines should be kept short and of equal length.

(2) For the high-speed signal lines, differential signals should be used, not single-ended signals, and these differential signals need to be loaded symmetrically to prevent unbalanced currents which will cause distortion in the signal.

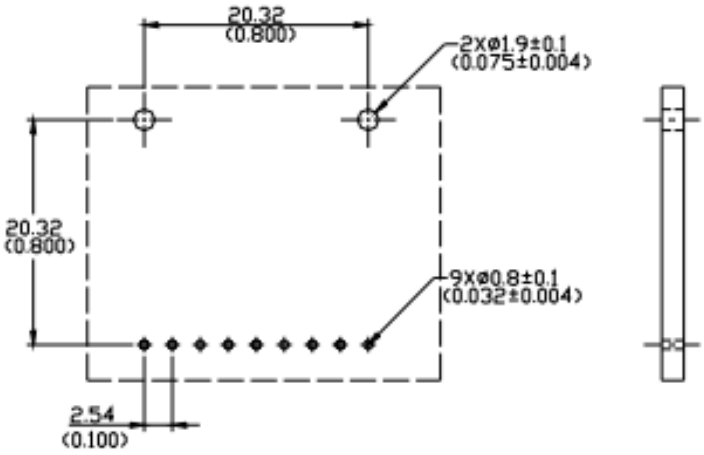
(3) Multi-layer plane PCB is best for distribution of $V_{CC}$, returning ground currents, forming transmission lines and shielding, Also, it is important to suppress noise from influencing the fiber-optic transceiver performance, especially the receiver circuit.

(4) A separate proper power supply filter circuits shown in Figure for the transmitter and receiver sections. These filter circuits suppress $V_{CC}$ noise over a broad frequency range, this prevents receiver sensitivity degradation due to $V_{CC}$ noise.

(5) Surface-mount components are recommended. Use ceramic bypass capacitors for the 0.1 μF capacitors and a surface-mount coil inductor for 1 μH inductor. Ferrite beads can be used to replace the coil inductors when using quieter $V_{CC}$ supplies, but a coil inductor is recommended over a ferrite bead. All power supply components need to be placed physically next to the $V_{CC}$ pins of the receiver and transmitter.

(6) Use a good, uniform ground plane with a minimum number of holes to provide a low-inductance ground current return for the power supply currents.

**RECOMMENDED BOARD LAYOUT HOLE PATTERN**

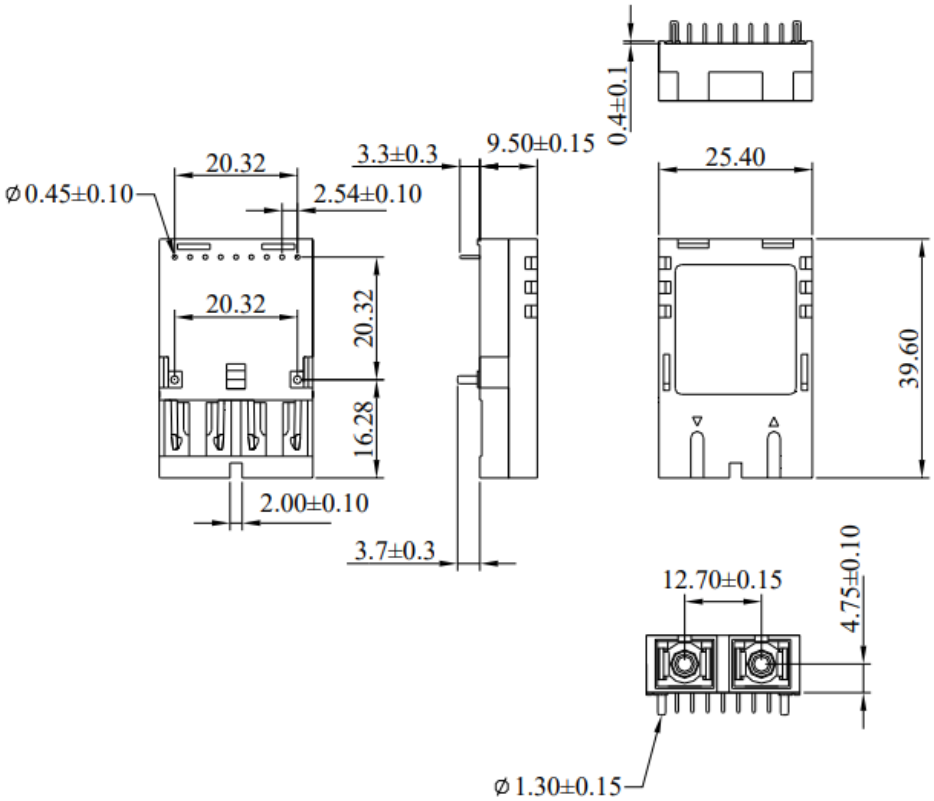



Unit : mm(inches)

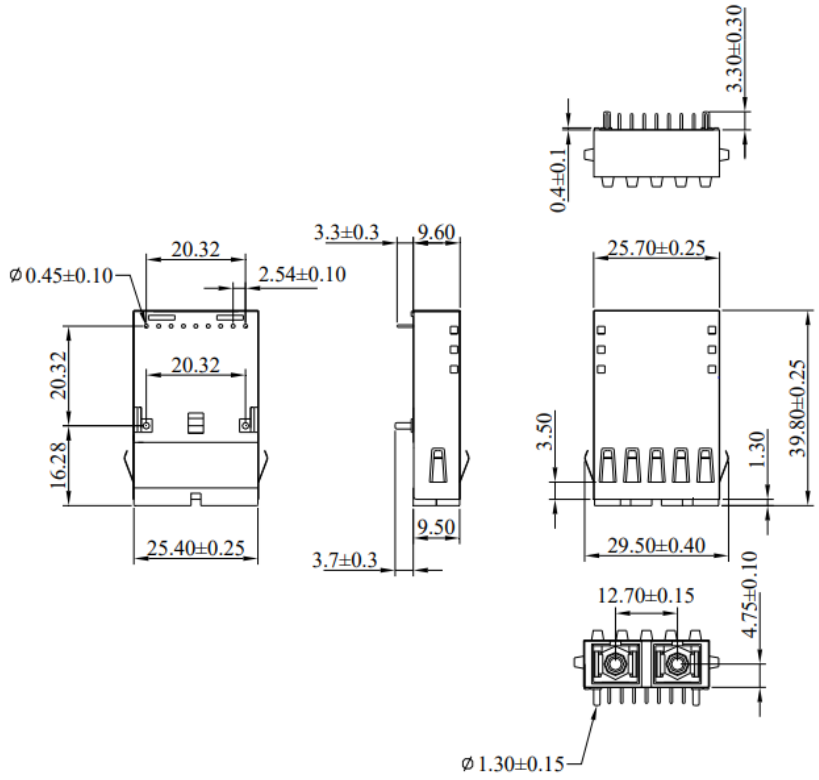
**DRAWING DIMENSIONS (unit: mm)**

All dimensions are ±0.20mm unless otherwise specified.

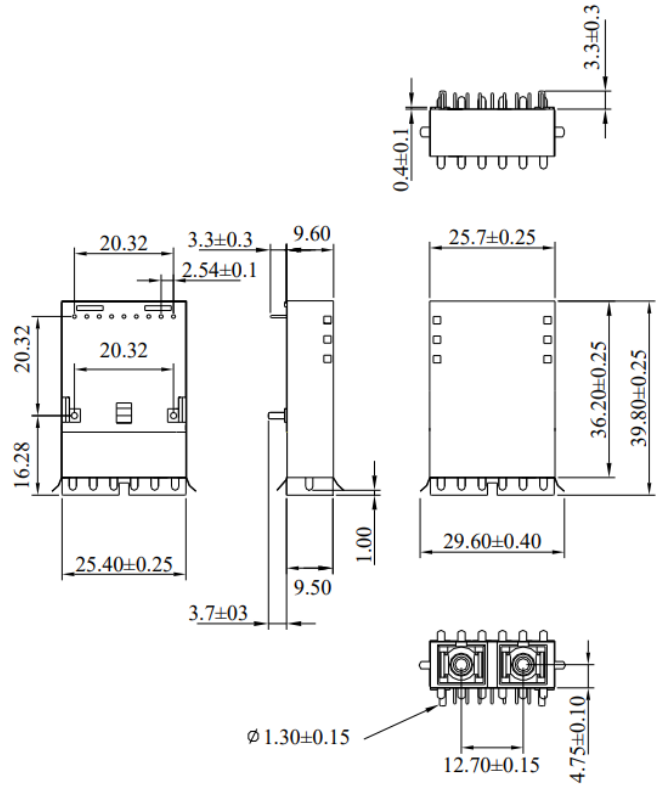
**No Shield**



**Backward Shield**




**Forward Shield**



**ADDITIONAL NOTES**

- Avoid eye or skin exposure to laser radiation.
- The device is sensitive to electro-static discharge (ESD). The device should be handled with ESD proof tools. To assemble the device on PCB, proper grounding is required to prevent ESD.
- Specifications are subject to change without notice.