

## Fast Ethernet Multimode SFF MT-RJ Transceivers

### Product Facts

- Compliant with FDDI PMD Standard
- Compliant with ATM 100 Mb/s Physical Layer performance specifications
- Compliant with 100 Base-FX version of the IEEE 802.3, 2002 performance specifications
- Single +3.3V power supply
- Data rates of 10 Mb/s to 125 Mb/s
- Complies with Small Form Factor (SFF) Multi-Source Agreement (MSA)
- High-density MT-RJ connector interface
- High reliability 1300 nm optics
- PECL and LVPECL compatible data interface
- Wave Solder and Aqueous Wash compatible
- UL 60950 recognized

### Applications

- ATM 100 Mb/s links
- Fast Ethernet links
- FDDI links
- Switches
- Repeaters
- Network interface cards
- Hubs
- Routers



Tyco Electronics' Fast Ethernet SFF MT-RJ Transceivers 269147-X are LED based 1300 nm fiberoptic transceiver modules intended for use in FDDI, ATM and Fast Ethernet multimode fiber physical layers. The transceiver sends and receives pre-encoded data over a pair of 62.5  $\mu$ m or 50  $\mu$ m core multimode optical fibers. The modules, which operate from a single +3.3V power supply, contain separate transmitter and receiver sections with PECL and LVPECL compatible data interfaces.

Technological advancements in precision optical design and ASIC design have enabled Tyco Electronics to produce low cost SFF transceivers. Package style is the multi-sourced 2 x 5 DIP style with an integral MT-RJ connector interface. This new small form factor is approximately half the width of a duplex SC 1 x 9 module, providing an effective center line

spacing of 0.55-inches from port to port, allowing the equipment designer to double the port density of a given product. These transceivers have a DC-coupled data interface that provides the highest degree of flexibility for use in a wide variety of circuit architectures. They have been extensively tested to comply with the FDDI LCF-PMD Standard. The FDDI PMD Standard is ISO/IEC 9314-3: 1990 and ANSI X3.166-1990. The 269147-X transceivers are intended for transmission distances up to 2 km over multimode fiber links.

The transceiver modules meet Class 1 Eye Safety requirements, as defined by IEC 60825-1. The modules have been designed with grounding and shielding features that minimize EMI susceptibility and radiated emissions. Units are supplied with process plugs.

| Application   | Part Number | Ground Tabs | EMI Gasket |
|---------------|-------------|-------------|------------|
| Fast Ethernet | 269147-3    | Yes         | Yes        |
| Fast Ethernet | 269147-4    | No          | Yes        |
| Fast Ethernet | 269147-5    | No          | No         |
| Fast Ethernet | 269147-6    | Yes         | No         |

## Fast Ethernet Multimode SFF MT-RJ Transceivers (Continued)

### Fast Ethernet Multimode SFF MT-RJ Transceivers

#### Part Numbers

269147-3

269147-4

269147-5

269147-6

### Transmitter Performance Specifications:

( $T_c=0$  to  $70^\circ\text{C}$ ,  $V_{cc}-V_{ee}=3.135$  to  $3.465\text{V DC}$ )

| Parameter                            | Symbol               | Notes      | Min                              | Typ  | Max                              | Units                          |
|--------------------------------------|----------------------|------------|----------------------------------|------|----------------------------------|--------------------------------|
| Data Rate (NRZ)                      | B                    | —          | 10                               | —    | 125                              | Mb/s                           |
| Optical Output (avg.)                | $P_{OUT}$            | 1,2        | -20                              | —    | -14                              | dBm                            |
| Extinction Ratio                     | —                    | 3          | —                                | 0.05 | 10                               | %                              |
| Optical Power at Logic Low "0" State | $P_{OUT}("0")$       | —          | —                                | —    | -45                              | dBm                            |
| Center Wavelength                    | $\lambda_{OUT}$      | 4          | 1270                             | 1320 | 1380                             | nm                             |
| Spectral Width (FWHM)                | $\Delta\lambda$      | 4          | —                                | 130  | —                                | nm                             |
| Duty Cycle Distortion                | —                    | —          | 0                                | —    | 1                                | ns                             |
| Data Dependent Jitter                | $t_{DDJ}$            | 5          | —                                | —    | 0.6                              | ns                             |
| Random Jitter                        | $t_{RJ}$             | 5          | —                                | —    | 0.76                             | ns                             |
| Output Rise Time                     | $t_{TLH}$            | 4,6        | 0.6                              | 1.2  | 3.5                              | ns                             |
| Output Fall Time                     | $t_{THL}$            | 4,6        | 0.6                              | 1.2  | 3.5                              | ns                             |
| Data Input Voltage Levels            | $V_{IL}$<br>$V_{IH}$ | 7,8<br>7,8 | $V_{CC}-1.810$<br>$V_{CC}-1.165$ | —    | $V_{CC}-1.475$<br>$V_{CC}-0.880$ | V<br>V                         |
| Data Input Current Levels            | $I_{IL}$<br>$I_{IH}$ | —<br>—     | -400<br>—                        | —    | —<br>400                         | $\mu\text{A}$<br>$\mu\text{A}$ |
| Power Supply Voltage                 | $V_{CC} - V_{EE}$    | —          | 3.135                            | 3.3  | 3.465                            | V                              |
| Supply Current                       | $I_{CC}$             | —          | —                                | —    | 120                              | mA                             |
| Operating Temperature                | $T_c$                | —          | 0                                | —    | 70                               | $^\circ\text{C}$               |

Note: All optical measurements made through a short patch cable, between 2 and 5 meters in length, using 62.5  $\mu\text{m}$  multimode fiber unless stated otherwise.

1. Meets Class I LED safety requirements of IEC 60825-1 when operated within the specified temperature and power supply ranges. Transmitter optical output power measured per TIA/EIA 455-95.
2. Specification applies to 0.275 NA 62.5/125  $\mu\text{m}$  multimode fiber.
3. (POL/POH) x 100%.
4. The output rise and fall time and spectral performance conform to ANSI X3.166 - 1990 (ISO / IEC 9314-3: 1990).
5. Driven with a differential signal.
6. Measured from 10% to 90% points on rising and falling edge of transmitted waveform.
7. When  $V_{BB}$  is used as the reference voltage.
8. Configured for LVPECL. Compatible with 10 K, 10 KH and 100 K ECL and PECL.

## Fast Ethernet Multimode SFF MT-RJ Transceivers (Continued)

### Fast Ethernet Multimode SFF MT-RJ Transceivers

#### Part Numbers

269147-3

269147-4

269147-5

269147-6

### Receiver Performance Specifications:

( $T_c=0$  to  $70^\circ\text{C}$ ,  $V_{cc}-V_{ee}=3.135$  to  $3.465\text{V DC}$ )

| Parameter                        | Symbol            | Notes | Min            | Typ | Max            | Units            |
|----------------------------------|-------------------|-------|----------------|-----|----------------|------------------|
| Data Rate (NRZ)                  | B                 | —     | 10             | —   | 125            | Mb/s             |
| Optical Input (avg.) Sensitivity | $P_{IN}$          | 1,2,3 | -31            | —   | -14.0          | dBm              |
| Optical Wavelength               | $\lambda_{IN}$    | —     | 1270           | —   | 1380           | nm               |
| Duty Cycle Distortion            | —                 | —     | 0              | —   | 1              | ns               |
| Data Dependent Jitter            | $t_{DDJ}$         | —     | 0              | —   | 1.2            | ns               |
| Random Jitter                    | $t_{RJ}$          | —     | 0              | —   | .76            | ns               |
| Output Rise Time                 | $t_{TLH}$         | 4     | 0.6            | —   | 5              | ns               |
| Output Fall Time                 | $t_{THL}$         | 4     | 0.6            | —   | 5              | ns               |
| Output Voltage Levels            | $V_{OH}$          | 5     | $V_{cc}-1.025$ | —   | $V_{cc}-0.880$ | V                |
|                                  | $V_{OL}$          | 5     | $V_{cc}-1.810$ | —   | $V_{cc}-1.620$ | V                |
| Signal Detect Output             | —                 | —     | —              | —   | —              | —                |
|                                  | $V_A$             | 5     | $V_{cc}-1.025$ | —   | $V_{cc}-0.880$ | V                |
|                                  | $V_D$             | 5     | $V_{cc}-1.810$ | —   | $V_{cc}-1.620$ | V                |
|                                  | —                 | —     | —              | —   | —              | —                |
| SD Power Levels (avg.)           | —                 | —     | —              | —   | —              | —                |
| Assert                           | $P_A$             | —     | —              | —   | -31            | dBm              |
| Deassert                         | $P_D$             | —     | -45            | —   | —              | dBm              |
| Hysteresis                       | —                 | —     | 1.5            | —   | —              | dB               |
| SD Delay Time                    | —                 | —     | 0              | —   | 100            | $\mu\text{s}$    |
|                                  | —                 | —     | 0              | —   | 350            | $\mu\text{s}$    |
| Power Supply Voltage             | $V_{cc} - V_{ee}$ | —     | 3.135          | 3.3 | 3.465          | V                |
| Supply Current                   | $I_{cc}$          | —     | —              | —   | 110            | mA               |
| Operating Temperature            | $T_c$             | —     | 0              | —   | 70             | $^\circ\text{C}$ |

Note: All optical measurements made through a short patch cable, between 2 and 5 meters in length, using 62.5  $\mu\text{m}$  multimode fiber unless stated otherwise.

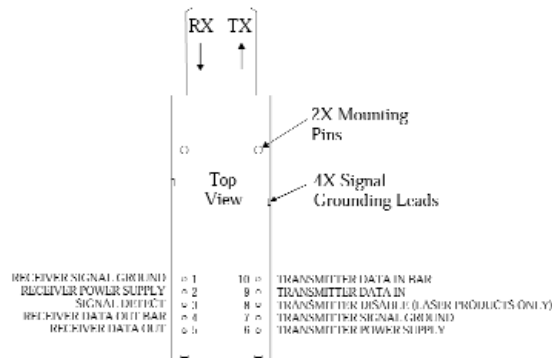
1. Measurement made at center of the eye.
2. Measured using the FDDI test signal format in ANSI X3.166 - 1990.
3.  $\text{BER} = 2.5 \times 10^{-10}$ .
4. Receiver electrical output rise and fall times measured from 10 to 90% points on rising and falling edge of waveform with 50 ohm load to  $V_{cc} - 2\text{V}$ .
5. Measured with a 50 ohm load to  $V_{cc} - 2\text{V}$ .

### Absolute Maximum Ratings:

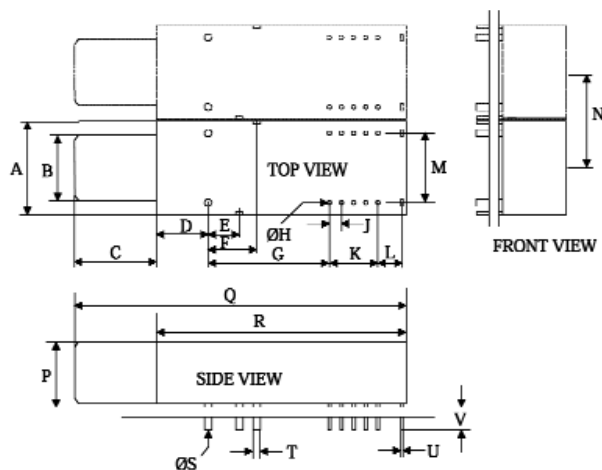
| Parameter                  | Symbol          | Units              | Min  | Max      |
|----------------------------|-----------------|--------------------|------|----------|
| Storage Temperature        | $T_s$           | $^\circ\text{C}$   | -40  | 85       |
| Lead Soldering Limits/Time | —               | $^\circ\text{C/s}$ | —    | 240/10   |
| Data Input Voltage         | $V_{INPUT}$     | V                  | -0.5 | $V_{cc}$ |
| Differential Input Voltage | $V_{DIFF}$      | V                  | —    | 2.0      |
| Supply Voltage             | $V_{cc}-V_{ee}$ | V                  | -0.2 | 5.0      |

## Fast Ethernet Multimode SFF MT-RJ Transceivers (Continued)

### Transceiver Pin Descriptions



### Package Outline Drawing



#### Notes:

1. This figure describes the package outline, mounting studs, pins and their relationships to each other.
2. Toleranced to accommodate round or rectangular leads.
3. All 12 pins and posts are to be treated as a single pattern.
4. The MT-RJ optical connector has a 750  $\mu$ m fiber spacing.
5. Refer to the MT-RJ Transceiver Pin Out Diagram for additional information.
6. This transceiver is supplied with an EMI gasket that fits onto the nose-piece and ensures an intimate fit between the nose-piece and the MSA defined customer front panel cut-out shown in Figure 4. Please refer to the Tyco Electronics' Customer Drawing number 269147 for additional details on these gasket dimensions.

|    | Millimeters |       |       | Inches |       |       |    | Millimeters |       |      | Inches |      |       |
|----|-------------|-------|-------|--------|-------|-------|----|-------------|-------|------|--------|------|-------|
|    | Min.        | Typ.  | Max.  | Min.   | Typ.  | Max.  |    | Min.        | Typ.  | Max. | Min.   | Typ. | Max.  |
| A  |             |       | 13.59 |        |       | 0.535 | L  |             | 3.56  |      | 0.140  |      |       |
| B  |             | 9.53  |       |        | 0.375 |       | M  |             | 10.16 |      | 0.400  |      |       |
| C  |             | 12.40 |       |        | 0.488 |       | N  | 13.97       |       |      | 0.550  |      |       |
| D  |             | 7.59  |       |        | 0.299 |       | P  |             | 9.53  |      | 0.375  |      |       |
| E  |             | 4.57  |       |        | 0.180 |       | Q  |             | 48.72 |      | 1.918  |      |       |
| F  |             | 7.11  |       |        | 0.280 |       | R  |             | 36.42 |      | 1.434  |      |       |
| G  |             | 17.78 |       |        | 0.700 |       | ØS | 0.97        |       | 1.07 | 0.038  |      | 0.042 |
| ØH | 0.41        |       | 0.61  | 0.016  |       | 0.024 | T  |             | 1.02  |      | 0.040  |      |       |
| J  |             | 1.78  |       |        | 0.070 |       | U  |             | 0.25  |      | 0.010  |      |       |
| K  |             | 7.12  |       |        | 0.280 |       | V  |             | 3.30  |      | 0.130  |      |       |

**IMPORTANT:** PLEASE SEE THE TYCO ELECTRONICS' CUSTOMER DRAWING 269147 FOR TRANSCEIVER HOUSING DIMENSIONS AND TOLERANCES. DRAWINGS CAN BE OBTAINED ON OUR WEBSITE AT: <http://www.tycoelectronics.com> OR CALL AMPFAX AT 1-800-522-6752 FOR 24HR FAX SERVICE.

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## Fast Ethernet Multimode SFF MT-RJ Transceivers (Continued)


### Pin-Out Description:

| Symbol                                | Pin No. | Function  |
|---------------------------------------|---------|---|
| Two Front Mounting Studs              |         | Provided for mechanical attachment to the PCB and ensure mechanical strength. The holes on the PCB that they attach to must be connected to chassis ground. |
| Four Holes for Signal Grounding Leads |         | Connect to signal ground.   |
| $V_{EEr}$                             | 1       | Receiver Signal Ground. Connect to receiver signal ground plane.  |
| $V_{CCr}$                             | 2       | Receiver Power Supply.  |
| SD                                    | 3       | Signal detect.<br>Normal Operation: Logic "1" Output.<br>Fault Condition: Logic "0" Output.   |
| RD-                                   | 4       | Received Data Out Bar. No internal terminations are provided.   |
| RD+                                   | 5       | Received Data Out. No internal terminations are provided.   |
| $V_{CCt}$                             | 6       | Transmitter Power Supply.   |
| $V_{EEt}$                             | 7       | Transmitter Signal Ground.  |
| $V_{Dis}$                             | 8       | No internal connection is provided. Transmitter Disable Input. Optional feature for laser based products only.  |
| TD+                                   | 9       | Transmitter Data In and Data In Bar. No internal terminations are provided. See recommended circuit schematic.  |
| TD-                                   | 10      | Transmitter Data In Bar. No internal terminations are provided. See recommended circuit schematic.  |

#### Note:

1.  $V_{EEr}$  and  $V_{EEt}$  are connected together inside the transceiver module.

### Regulatory Compliance:

| Agency   | Test Method  | Listing Document   |
|--|--|--|
| TUV  | EN60825-1:1994_A11:1996<br>EN60825-2:1994+A1<br>EN60950:1992+A1+A2+A3+A4+A11 | TUV Product Services<br>LED Class I<br>Protection Class III<br>TUV Certification Number: B020546940002 |
| UL/  US | UL 60950   | E141081  |

### ESD Testing:

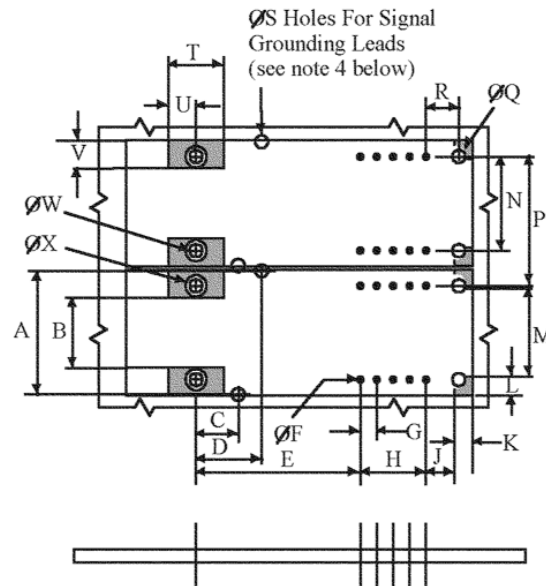
| Test | Test Method  | Procedure   |
|------|--|---|
| ESD1 | JEDEC/EIA JESD22-A114-A<br>(C=100 pF, R=1500 ohm - Human body model)       | Pulses applied to each pin and Ground at 1 KV   |
| ESD2 | 25 KV maximum air discharge<br>(simulates human body discharge into a DUT) | 40 discharges are applied per DUT (10 at each of the top, nose, right, and left). Each module is tested with both power ON and OFF. |

### Related Documents:

Fast Ethernet Multimode SFF MT-RJ Transceivers Application Specification #114-1307144

## Fast Ethernet Multimode SFF MT-RJ Transceivers (Continued)

**Figure 3: MSA Recommended Circuit Board Layout**



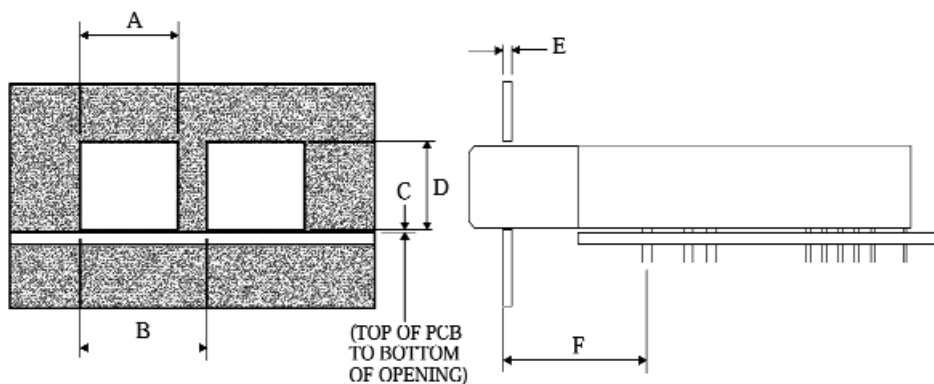
**Notes:**

1. This figure describes the recommended circuit board layout for the MT-RJ Transceiver placed at a 0.550 inch spacing.
2. The shaded areas are keep-out areas reserved for housing standoffs. No metal traces or Ground connection in keep-out areas.
3. The 10 pin module implementation requires only 16 PCB holes.
4. These four holes for signal grounding leads must be connected to signal ground on the PCB.
5. Solder Posts should be soldered to the PCB for mechanical strength and these PCB holes should be connected to chassis ground.

|    | Millimeters |       |      | Inches |       |       |    | Millimeters |       |      | Inches |       |       |
|----|-------------|-------|------|--------|-------|-------|----|-------------|-------|------|--------|-------|-------|
|    | Min.        | Typ.  | Max. | Min.   | Typ.  | Max.  |    | Min.        | Typ.  | Max. | Min.   | Typ.  | Max.  |
| A  |             | 13.34 |      |        | 0.525 |       | M  |             | 9.59  |      |        | 0.378 |       |
| B  |             | 7.59  |      |        | 0.299 |       | N  |             | 10.16 |      |        | 0.400 |       |
| C  |             | 4.57  |      |        | 0.180 |       | P  | 13.97       |       |      | 0.550  |       |       |
| D  |             | 7.11  |      |        | 0.280 |       | ØQ |             |       | 2.29 |        |       | 0.090 |
| E  |             | 17.78 |      |        | 0.700 |       | R  |             | 3.56  |      |        | 0.140 |       |
| ØF | 0.71        | 0.81  | 0.91 | 0.028  | 0.032 | 0.036 | ØS | 1.3         | 1.4   | 1.5  | 0.051  | 0.055 | 0.059 |
| G  |             | 1.78  |      |        | 0.070 |       | T  |             | 6.00  |      |        | 0.236 |       |
| H  |             | 7.12  |      |        | 0.280 |       | U  |             | 3.00  |      |        | 0.118 |       |
| J  |             | 3.08  |      |        | 0.121 |       | V  |             | 3.00  |      |        | 0.118 |       |
| K  |             | 2.00  |      |        | 0.079 |       | ØW | 1.3         | 1.4   | 1.5  | 0.051  | 0.055 | 0.059 |
| L  |             | 2.00  |      |        | 0.079 |       | ØX |             |       | 2.29 |        |       | 0.090 |

## Fast Ethernet Multimode SFF MT-RJ Transceivers (Continued)

**Figure 4: MSA Recommended MT-RJ Front Panel Opening**



|   | Millimeters |       |       | Inches |       |       |
|---|-------------|-------|-------|--------|-------|-------|
|   | Min.        | Typ.  | Max.  | Min.   | Typ.  | Max.  |
| A | 10.70       | 10.80 | 10.90 | 0.421  | 0.425 | 0.429 |
| B | 13.97       |       |       | 0.550  |       |       |
| C |             | 0.25  |       |        | 0.010 |       |
| D | 9.70        | 9.80  | 9.90  | 0.382  | 0.386 | 0.390 |
| E |             | 1.00  |       |        | 0.039 |       |
| F | 15.50       |       | 16.25 | 0.610  |       | 0.640 |