

Preliminary Technical Data (Rev. 0.1, June 22, 2000)

HITACHI

TRM7954AN

STM-16 1.5 μm Optical Transmitter (for 50 GHz Spacing DWDM)

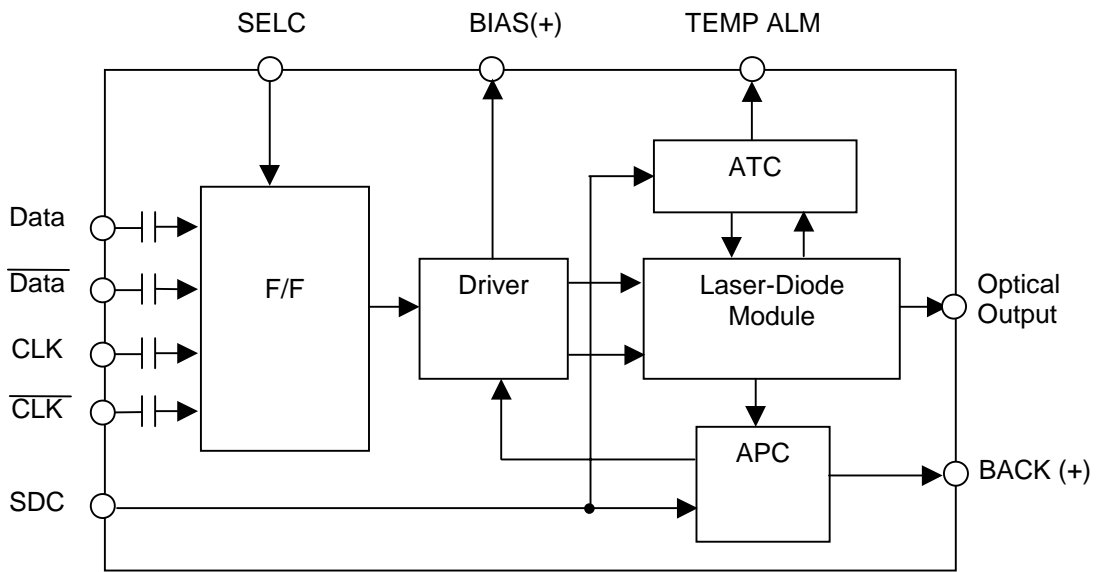
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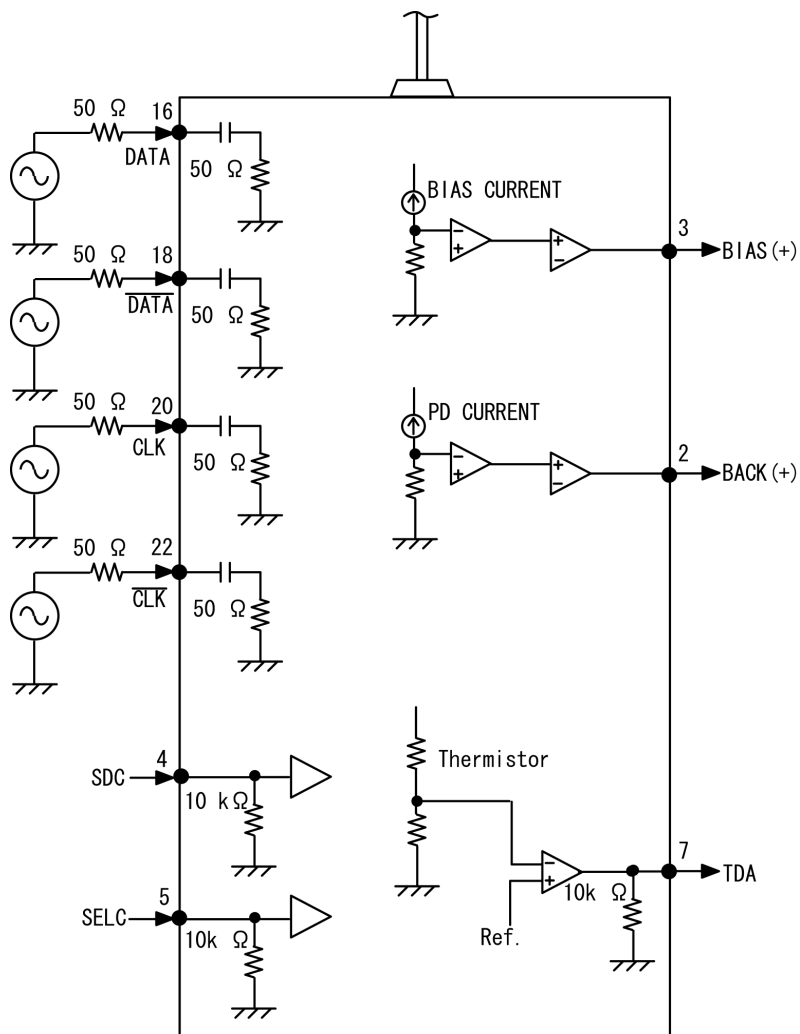
FEATURES

- **Data rates up to 2.5 Gbit/s**
- **Long-haul Transmission Length (400 km)**
- **Wavelength range, 1530.72 nm – 1562.23 nm**
- **ITU-Grid Channel (50 GHz Spacing)**
- **Compact size (51 x 73.4 x 12.7 mm³)**
- **Integrated Wavelength Lock Mechanism**
- **Laser bias monitor output**
- **Laser back-facet monitor output**
- **Laser Temperature Deviation Alarm**

Block Diagram



Recommended Circuit



PERFORMANCE SPECIFICATIONS

Table 1. Absolute Maximum Ratings

| No. | Item | Symbol | Rated Value | Unit | Note |
|-----|----------------------------|--------|--------------|------|------|
| 1 | DC Power Supply (+5.0 V) | - | -0.3 to +6.0 | V | Vcc |
| 2 | DC Power Supply (-5.2 V) | - | -6.0 to +0.3 | V | Vee |
| 3 | DC Power Supply (+3.3 V) | - | -0.3 to +4.0 | V | Vtt |
| 4 | Operating Case Temperature | Topr. | 0 to +70 | °C | |
| 5 | Storage Case Temperature | Tstg. | -20 to +75 | °C | |
| 6 | Lead Soldering Temperature | - | ≤250 | °C | |
| 7 | Lead Soldering Time | - | ≤10 | s | |

Table 2. Operating Environment

Electrical and optical characteristics below are defined under this operating environment, unless otherwise specified.

| No. | Parameter | Symbol | Min. | Typ. | Max. | Unit | Remarks |
|-----|-----------------------|-----------------|--------|------|--------|------|---------|
| 1 | Supply Voltage | V _{CC} | 4.75 | 5.0 | 5.25 | V | |
| 2 | Supply Voltage | V _{DD} | 3.13 | 3.3 | 3.47 | V | |
| 3 | Supply Voltage | V _{EE} | -4.94 | -5.2 | -5.45 | V | |
| 4 | Supply Current | I _{CC} | - | - | 0.8 | A | +5 V |
| 5 | Supply Current | I _{DD} | - | - | 2.0 | A | +3.3 V |
| 6 | Supply Current | I _{EE} | - | - | 1.8 | A | -5.2 V |
| 7 | Power Consumption | P _{DS} | - | - | 14 | W | |
| 8 | Operating Temperature | T _C | (Note) | 25 | (Note) | °C | Case |

Note: Target specification is minimum of 0 and maximum of 65.

Table 3. DC Power Supply

| No. | Item | Symbol | Min. | Typ. | Max. | Unit |
|-----|-------------------------|--------|-------|-------|-------|------|
| 1 | Positive Supply Voltage | Vcc | +4.75 | +5.00 | +5.25 | V |
| 2 | Negative Supply Voltage | Vee | -4.94 | -5.20 | -5.46 | V |
| 3 | TEC Supply Voltage | Vtt | +3.15 | +3.30 | +3.45 | V |
| 4 | Positive Supply Current | Icc | - | - | 400 | mA |
| 5 | Negative Supply Current | Iee | - | - | 250 | mA |
| 6 | TEC Supply Current | Itt | - | - | 1300 | mA |
| 7 | Total Power Consumption | Pc | - | - | 6.5 | W |

Table 4. Optical Characteristics

| No. | Item | Symbol | Min. | Typ. | Max. | Unit | Remarks (Note 1) |
|-----|--------------------------------|----------------------|---------------------|--------|--------------|------|--|
| 1 | Average Power Output | Pf | -3.5 -4.5 | - - | +2.0 +2.0 | dBm | Point S, Beginning of life Point S, End of life |
| 2 | Extinction Ratio | ER | 10 | - | - | dB | |
| 3 | Optical Waveform | - | Satisfying the Mask | | | - | Note 2 |
| 4 | Optical Output at Shutdown | - | - | - | -40 | dBm | |
| 5 | Center Wavelength | λ_c | 1528.77 | - | 1563.86 | nm | 50 GHz Spacing |
| 6 | Variation in Center Wavelength | $\Delta\lambda$ | -0.04 | | +0.04 | nm | End of Life, TBD |
| 7 | Spectral Width (-20 dB) | $\Delta\lambda_{20}$ | - | - | 0.5 | nm | |
| 8 | Side-mode Suppression Ratio | Sr | 30 | - | - | dB | |
| 9 | Optical Path Penalty | Pp | - | - | 2 | dB | 6400 ps/nm, Note 3 |

Note 1. Transmit Data: NRZ at 2.488320 Gbit/s, Mark 50%, PRBS= $2^{23}-1$,
Power Supply Voltage: $V_{cc} = 5.0^{+0.25}$ V, $V_{ee} = -5.2^{+0.26}$ V, $V_{tt} = 3.3^{+0.16}$
 $T_c = 0$ to 75°C

Note 2.

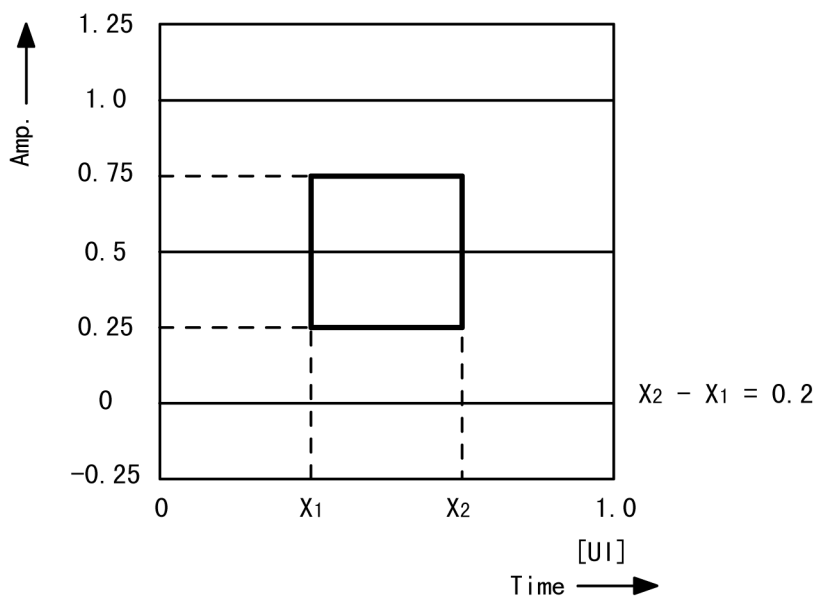


Fig. 4.1 Mask of Eye Diagram for the Optical Waveform through the 4th-order Bessel Filter According to ITU-T G957

Note 3.

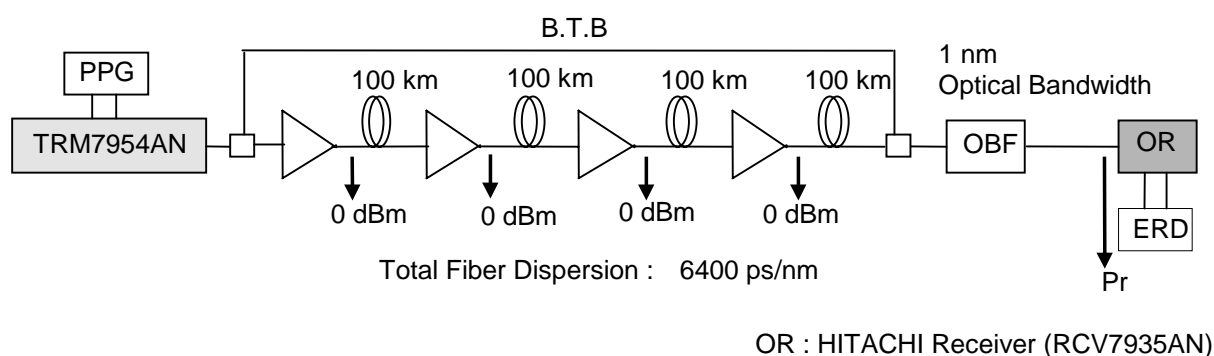


Fig 4.2 Optical Path Penalty Measurement Setup

Table 5 Input/Output Signal Interface

| No. | Item | Min. | Typ. | Max. | Unit | Remarks (Note 1) | |
|-----|--|---|------|------|----------|------------------|--------------|
| 1 | Optical Connector | FC-PC | | | - | | |
| 2 | Data Input Impedance | 50 | | | Ω | AC-coupled | |
| 3 | Input Data Voltage | Single | 500 | - | 1000 | mV | peak to peak |
| | | Differential | 300 | - | 1000 | | |
| 4 | Clock Input Impedance | 50 | | | Ω | AC-coupled | |
| 5 | Input Clock Voltage | Single | 500 | - | 1000 | mV | peak to peak |
| | | Differential | 300 | - | 1000 | | |
| 6 | Input Clock Duty Cycle | 40 | 50 | 60 | % | | |
| 7 | Setup time and Hold time | - | - | 75 | ps | Note 2 | |
| 8 | Shutdown Command Interface | TTL Level Active High | | | - | Note 3 | |
| 9 | Shutdown activation time | - | - | 5 | ms | | |
| 10 | Shutdown deactivation time | - | - | 250 | ms | | |
| 11 | Clock Mode Select Interface | TTL Level: High: Non-clocked mode Low: Clocked mode | | | - | Note 4 | |
| 12 | Temperature Deviation Alarm | TTL Level Active High | | | - | Note 5 | |
| 13 | Monitoring for LD bias current (BIAS(+)) | - | 20 | - | mV/mA | | |
| 14 | Monitoring for back facet PD current (BACK(+)) | 450 | 500 | 550 | mV | Note 6 | |

Note 1 Transmit Data: NRZ at 2.488320 Gbit/s, Mark 50%, PRBS=2²³-1,
 Power Supply Voltage: Vcc = 5.0^{+0.25} V, Vee = -5.2^{+0.26} V, Vtt = 3.3^{+0.16}
 Tc = 0 to 75°C

Note 2.

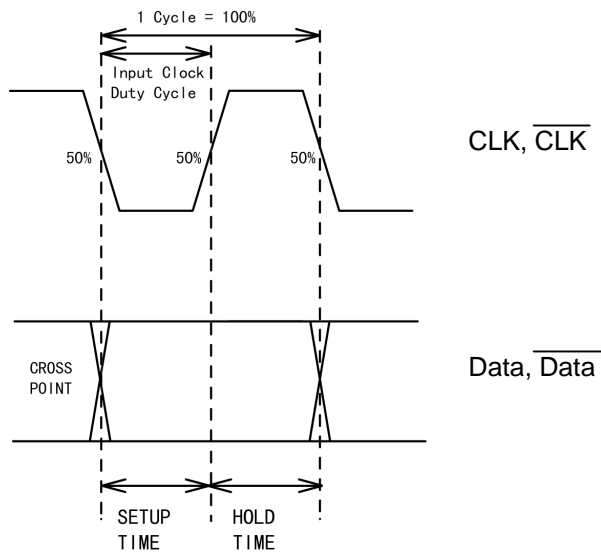


Fig. 5.1 Setup Time and Hold Time

Note 3.

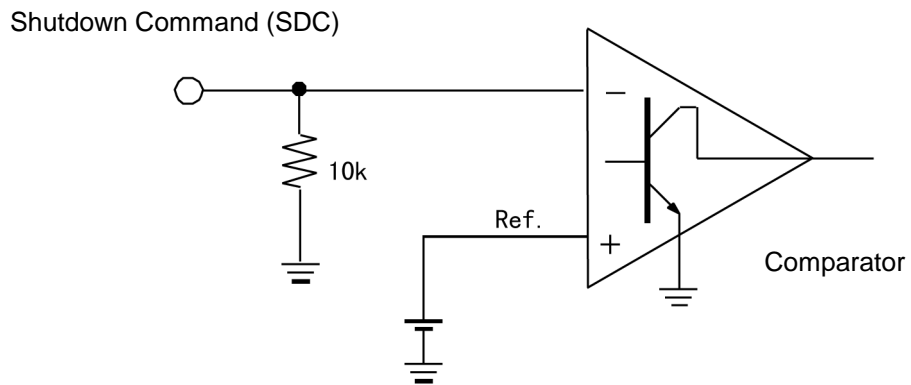


Fig. 5.2 Shutdown Command Interface

Note 4.

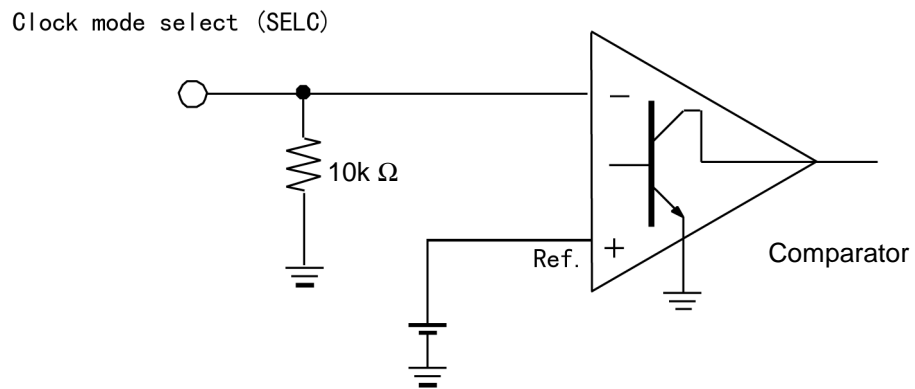


Fig. 5.3 Clock Mode Select Interface

Note 5.

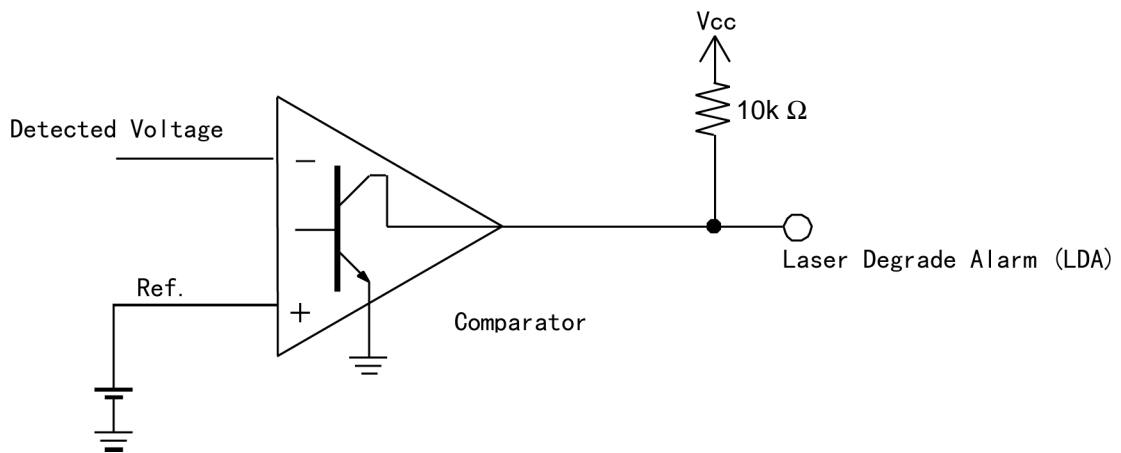


Fig. 5.4 Temperature Deviation Alarm Interface

Note 6.

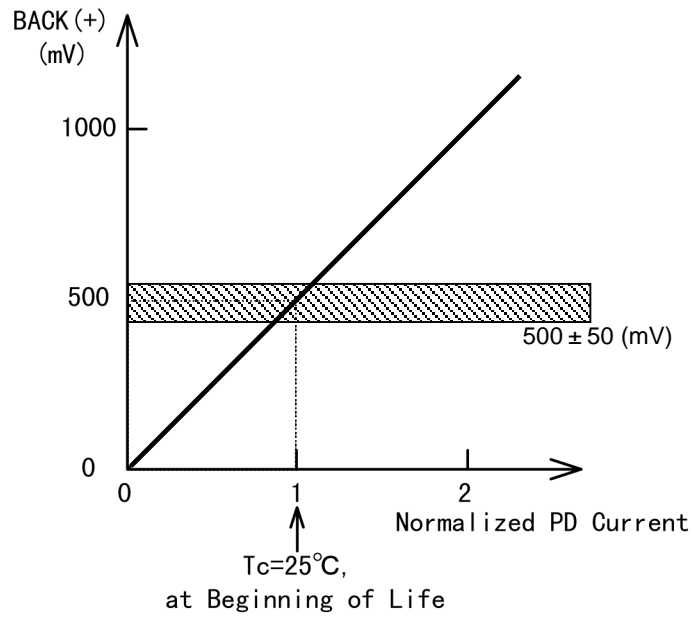


Fig. 5.5 Monitoring for Back Facet PD Activation

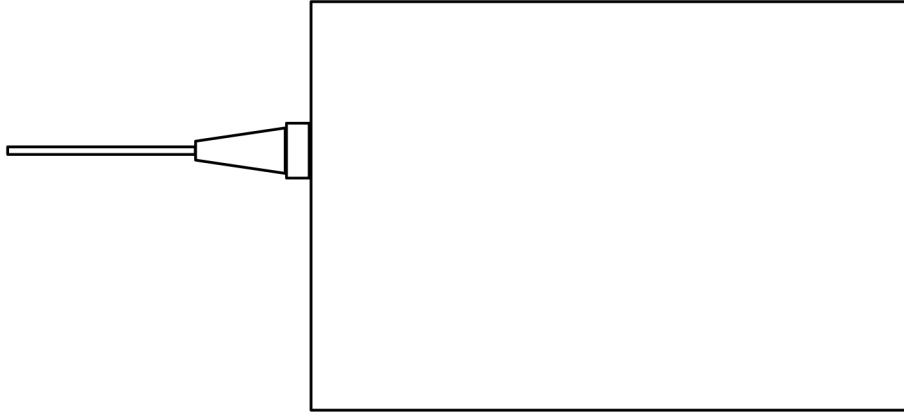
Table 6. Pin Configuration

| Pin # | Symbol | I/O | Logic | Description | Remarks |
|-------|--------------------------|-----|-------|--------------------------------------|---------|
| 1 | GND | | | Ground | |
| 2 | BACK(+) | | | Monitoring for back facet PD current | |
| 3 | BIAS(+) | | | Monitoring for LD bias current | |
| 4 | SDC | | | Shutdown Command | |
| 5 | SELC | | | Clock mode select | |
| 6 | GND | | | Ground | |
| 7 | TDA | | | Temperature Deviation Alarm | |
| 8 | NUC | | | No User Connection | |
| 9 | NUC | | | No User Connection | |
| 10 | NUC | | | No User Connection | |
| 11 | GND | | | Ground | |
| 12 | Vee | | | Negative power supply | |
| 13 | Vcc | | | Positive power supply | |
| 14 | Vtt | | | TEC power supply | |
| 15 | GND | | | Ground | |
| 16 | DATA | | | True data input | |
| 17 | GND | | | Ground | |
| 18 | $\overline{\text{DATA}}$ | | | False data input | |
| 19 | GND | | | Ground | |
| 20 | CLK | | | True clock input | |
| 21 | GND | | | Ground | |
| 22 | $\overline{\text{CLK}}$ | | | False clock input | |
| 23 | GND | | | Ground | |
| 24 | Vcc | | | Positive power supply | |
| | | | | Metal Case is at GND. | |

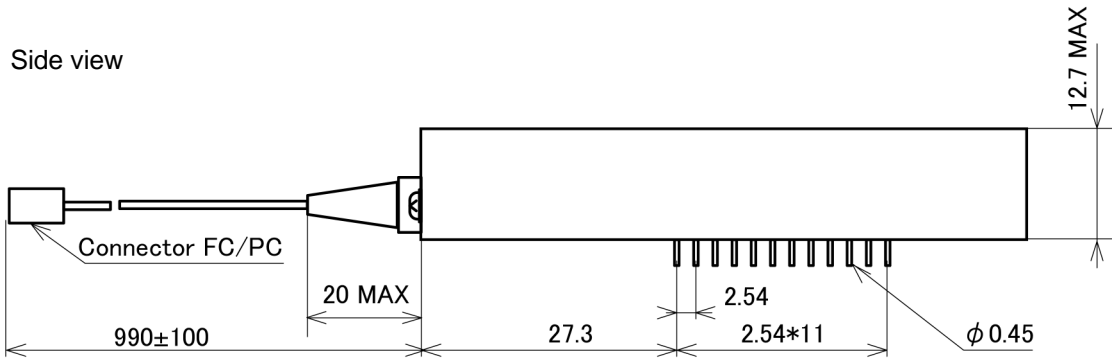
Mechanical Dimensions

Dimensions: mm
Tolerance : ± 0.5 mm

Top view



Side view



Bottom view

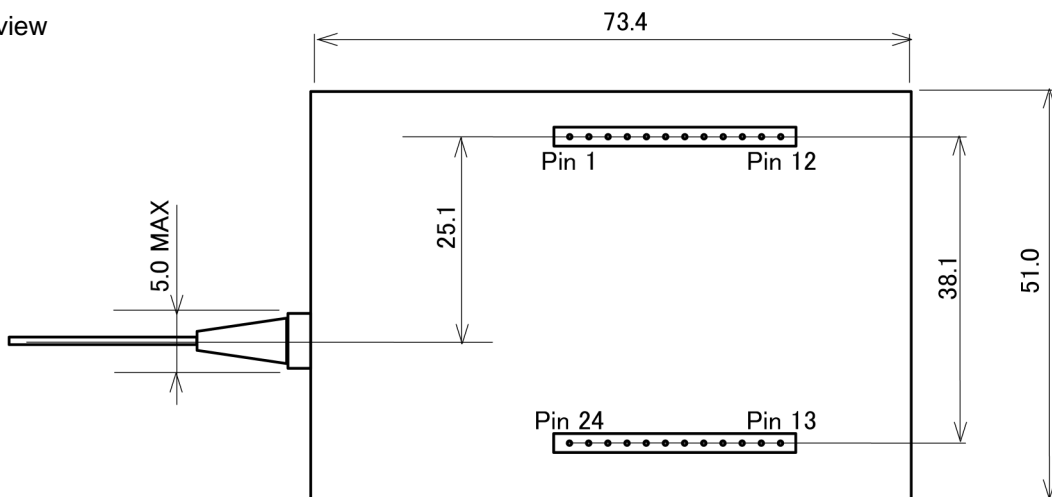


Table 6. Optical Fiber

| No. | Item | Specifications | Unit |
|-----|-------------------------------------|----------------|---------------|
| 1 | Type | SMF | - |
| 2 | Mode Field Diameter | 9.5 ± 1 | μm |
| 3 | Cladding Diameter | 125 ± 3 | μm |
| 4 | Minimum Bending Radius | 30 | mm |
| 5 | Fiber Tensile Strength | 9.8 | N |
| 5 | Outer Diameter of Secondary Coating | 0.9 ± 0.1 | mm |

Table 7. Ordering Information

| No. | Production Code | Center Wavelength (nm) | No. | Production Code | Center Wavelength (nm) |
|-----|-----------------|------------------------|-----|-----------------|------------------------|
| 01 | TRM7954AN3072 | 1530.72 | 41 | TRM7954AN4662 | 1546.62 |
| 02 | TRM7954AN3112 | 1531.12 | 42 | TRM7954AN4692 | 1546.92 |
| 03 | TRM7954AN3151 | 1531.51 | 43 | TRM7954AN4732 | 1547.32 |
| 04 | TRM7954AN3190 | 1531.90 | 44 | TRM7954AN4772 | 1547.72 |
| 05 | TRM7954AN3229 | 1532.29 | 45 | TRM7954AN4811 | 1548.11 |
| 06 | TRM7954AN3268 | 1532.68 | 46 | TRM7954AN4851 | 1548.51 |
| 07 | TRM7954AN3307 | 1533.07 | 47 | TRM7954AN4891 | 1548.91 |
| 08 | TRM7954AN3347 | 1533.47 | 48 | TRM7954AN4932 | 1549.32 |
| 09 | TRM7954AN3386 | 1533.86 | 49 | TRM7954AN4972 | 1549.72 |
| 10 | TRM7954AN3425 | 1534.25 | 50 | TRM7954AN5012 | 1550.12 |
| 11 | TRM7954AN3464 | 1534.64 | 51 | TRM7954AN5052 | 1550.52 |
| 12 | TRM7954AN3504 | 1535.04 | 52 | TRM7954AN5092 | 1550.92 |
| 13 | TRM7954AN3543 | 1535.43 | 53 | TRM7954AN5132 | 1551.32 |
| 14 | TRM7954AN3582 | 1535.82 | 54 | TRM7954AN5172 | 1551.72 |
| 15 | TRM7954AN3622 | 1536.22 | 55 | TRM7954AN5212 | 1552.12 |
| 16 | TRM7954AN3661 | 1536.61 | 56 | TRM7954AN5252 | 1552.52 |
| 17 | TRM7954AN3700 | 1537.00 | 57 | TRM7954AN5293 | 1552.93 |
| 18 | TRM7954AN3740 | 1537.40 | 58 | TRM7954AN5333 | 1553.33 |
| 19 | TRM7954AN3779 | 1537.79 | 59 | TRM7954AN5373 | 1553.73 |
| 20 | TRM7954AN3819 | 1538.19 | 60 | TRM7954AN5413 | 1554.13 |
| 21 | TRM7954AN3858 | 1538.58 | 61 | TRM7954AN5454 | 1554.54 |
| 22 | TRM7954AN3898 | 1538.98 | 62 | TRM7954AN5494 | 1554.94 |
| 23 | TRM7954AN3937 | 1539.37 | 63 | TRM7954AN5534 | 1555.34 |
| 24 | TRM7954AN3977 | 1539.77 | 64 | TRM7954AN5575 | 1555.75 |
| 25 | TRM7954AN4016 | 1540.16 | 65 | TRM7954AN5615 | 1556.15 |
| 26 | TRM7954AN4056 | 1540.56 | 66 | TRM7954AN5655 | 1556.55 |
| 27 | TRM7954AN4095 | 1540.95 | 67 | TRM7954AN5696 | 1556.96 |
| 28 | TRM7954AN4135 | 1541.35 | 68 | TRM7954AN5736 | 1557.63 |
| 29 | TRM7954AN4175 | 1541.75 | 69 | TRM7954AN5777 | 1557.77 |
| 30 | TRM7954AN4214 | 1542.14 | 70 | TRM7954AN5817 | 1558.17 |
| 31 | TRM7954AN4254 | 1542.54 | 71 | TRM7954AN5858 | 1558.58 |
| 32 | TRM7954AN4294 | 1542.94 | 72 | TRM7954AN5898 | 1558.98 |
| 33 | TRM7954AN4333 | 1543.33 | 73 | TRM7954AN5939 | 1559.39 |
| 34 | TRM7954AN4373 | 1543.73 | 74 | TRM7954AN5979 | 1559.79 |
| 35 | TRM7954AN4413 | 1544.13 | 75 | TRM7954AN6020 | 1560.20 |
| 36 | TRM7954AN4453 | 1544.53 | 76 | TRM7954AN6061 | 1560.61 |
| 37 | TRM7954AN4492 | 1544.92 | 77 | TRM7954AN6101 | 1561.01 |
| 38 | TRM7954AN4532 | 1545.32 | 78 | TRM7954AN6142 | 1561.42 |
| 39 | TRM7954AN4572 | 1545.72 | 79 | TRM7954AN6183 | 1561.83 |
| 40 | TRM7954AN4612 | 1546.12 | 80 | TRM7954AN6223 | 1562.23 |

USER INFORMATION

Handling Precautions

CAUTION: Take proper electrostatic-discharge (ESD) precautions while handling these devices. These devices are sensitive to ESD.

Laser Safety

This product complies with IEC 60825-1 Class 1.

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Revision History

| Rev. | Date | Page/Line/Fig/Table | Modification | Note |
|------|---------------|---------------------|--------------|------|
| 0.1 | June 22, 2000 | - | - | |