

155Mbps SFP transceiver modules without DDM function

RTXM139 Series II

Features

- *Duplex LC receptacle optical interface*
- *Single +3.3V power supply*
- *Hot-pluggable*
- *AC coupling of PECL signals*
- *Serial ID module on MOD(0-2)*
- *International Class 1 laser safety certified*
- *Transmitter disable input*
- *Receiver Loss of Signal Output*
- *Operating temperature range: -10°C ~ +70°C*
- *Compliant with RoHS&WEEE*

Application

- *SDH/ STM-1, SONET/OC-3*
- *Fast Ethernet*
- *Metropolitan area network*
- *Other optic link*

Standard

- *Compliant with SFP MSA (INF-8074i)*
- *Compliant with ITU-T G.957 STM-1*
- *Compliant with RoHS&WEEE*

Absolute Maximum Ratings

| Parameter | Symbol | Unit | Min | Max |
|--------------------------------|----------|------|------|-----|
| Storage Temperature Range | T_s | °C | -40 | +85 |
| Relative Humidity(without dew) | RH | % | 8 | 80 |
| Supply Voltage | V_{CC} | V | -0.5 | 4 |

Recommended Operating Conditions

| Parameter | Symbol | Unit | Min | Typ | Max |
|----------------------------------|----------|------|-------|--------|-------|
| Case Operating Temperature Range | T_C | °C | -10 | - | 70 |
| Power Supply Voltage | V_{CC} | V | 3.135 | 3.3 | 3.465 |
| Data rate | | Mb/s | - | 155.52 | - |

Specifications

(tested under recommended operating conditions, unless otherwise noted)

| Parameter | Symbol | Min | Type | Max | Units | Notes |
|--|----------|-----|------|----------|------------------|-------|
| Electrical Characteristics | | | | | | |
| Supply Current | I_{CC} | - | - | 300 | mA | 1 |
| Transmitter Differential Input Voltage | V_{IN} | 300 | - | 2200 | mV _{pp} | |
| Receiver Differential Output Voltage | V_O | 600 | - | 1200 | mV _{pp} | |
| Transmit Fault (TX_Fault) | V_{OH} | 2.0 | - | V_{CC} | V | |
| | V_{OL} | 0 | - | 0.8 | V | |
| Loss of Signal (LOS) | V_{OH} | 2.0 | - | V_{CC} | V | |
| | V_{OL} | 0 | - | 0.8 | V | |
| Transmitter Disable (TX-Disable) | V_{IH} | 2.0 | - | V_{CC} | V | |
| | V_{IL} | 0 | - | 0.8 | V | |
| MOD-DEF1, 2 | V_{IH} | 2.0 | - | V_{CC} | V | |
| Optical transmitter Characteristics | | | | | | |
| Launched Power(avg.) | P_o | -15 | -10 | -8 | dBm | |

| | | | | | |
|-------------------------------|--|-------|------|------|------------------------|
| | | -23.5 | -14 | | |
| Output center wavelength | λ_c | 1261 | 1310 | 1360 | nm |
| | | 1430 | 1550 | 1580 | nm |
| Output spectrum width | $\Delta\lambda$ | - | - | 7.7 | nm RMS(1310nmFP-LD) |
| | | - | - | 1 | nm -20dB(1550nmDFB-LD) |
| SMSR(dB) | | 30 | - | - | DFB-LD |
| Extinction ratio | E_R | 8.2 | - | - | dB |
| Output eye | Compliant with ITU-T G.957 STM-1 eye masks when filtered | | | | |
| Optical rise/fall time | t_r / t_f | - | - | 1.5 | ns |
| Transmitter jitter | TJ | | | 0.1 | UIp-p 2 |
| Relative intensity noise | RIN | - | - | -120 | dB/Hz 3 |
| P_{out} TX-Disable Asserted | P_{off} | - | - | -45 | dBm |

Optical receiver Characteristics

| | | | | | | | | |
|----------------|-------------------|----|-----|-----|-----|------|-----|---|
| Sensitivity | S | - | - | -23 | dBm | 2km | SMF | 4 |
| | | | | -31 | dBm | 2km | MMF | |
| | | - | -34 | -31 | dBm | 15km | | |
| Overload | P_{in} | -8 | - | - | dBm | | | |
| LOS | Optical decreased | - | -45 | - | - | dB | | |
| | Optical increased | - | - | - | -32 | dB | | |
| LOS hysteresis | | - | 0.5 | 3 | 5 | dB | | 5 |

Note1: The supply current includes SFP module's supply current and test board working current.

Note2: For the jitter measurements, the device was driven with SONET OC-3 data pattern with $2^{23}-1$ PRBS payload.

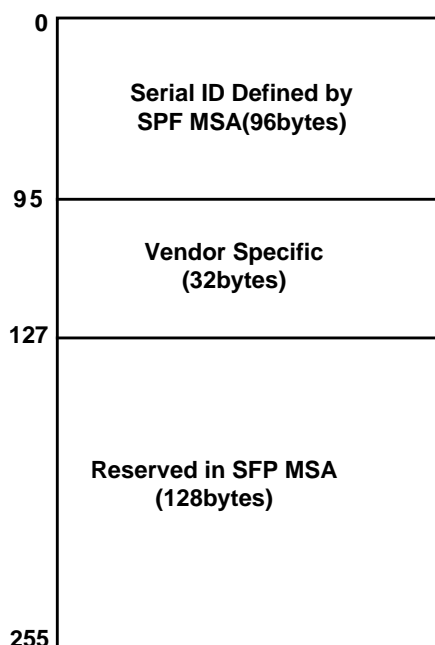
Note3: RIN is the laser noise, integrated over a specified bandwidth, measured relative to average optical power with 12dB return loss.

Note4: Measured with a PRBS $2^{23}-1$ test pattern, @155Mb/s, EX=10dB, BER< 10^{-10} .

Note5: The LOS Hysteresis to minimize "chatter" on the output line. In principle, Hysteresis alone does not guarantee chatter-free operation.

Digital Diagnostic Memory Map

2 wire address 1010000X (A0)



EEPROM Serial ID Memory Contents

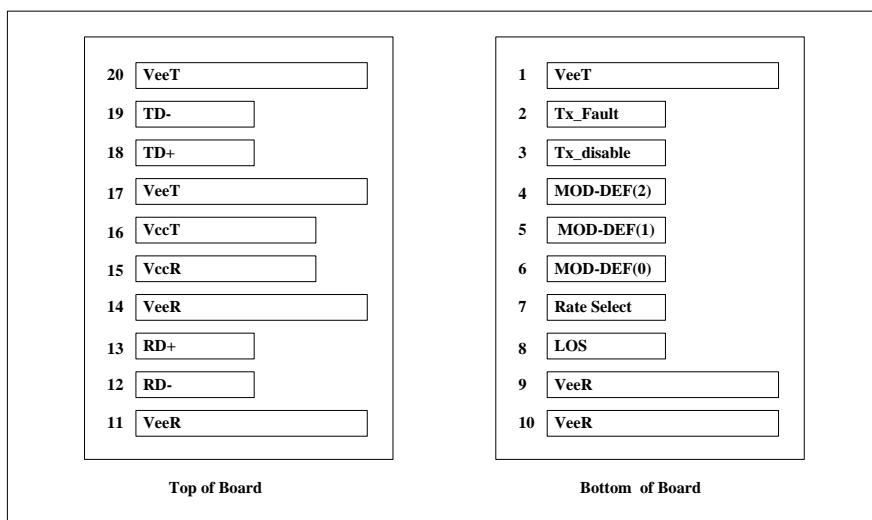
Accessing Serial ID Memory uses the 2 wire address 1010000X (A0). Memory Contents of Serial ID are shown in the Table 1.

Table 1: Serial ID Memory Contents

| Data Address (Bytes) | Size | Name of Field | Contents(Hex) | Description |
|----------------------|------|-------------------|-------------------------|---|
| BASE ID FIELDS | | | | |
| 0 | 1 | Identifier | 03 | SFP |
| 1 | 1 | Ext. Identifier | 04 | SFP function is defined by serial ID only |
| 2 | 1 | Connector | 07 | LC Connector |
| 3-10 | 8 | Transceiver | | Transceiver Codes |
| 11 | 1 | Encoding | 03 | NRZ |
| 12 | 1 | BR, Nominal | 01 | 155Mbit/s |
| 13 | 1 | Reserved | 00 | |
| 14 | 1 | Length (9μm) km | | Transceiver transmit distance |
| 15 | 1 | Length (9μm) 100m | | |
| 16 | 1 | Length (50μm) 10m | | |
| 17 | 1 | Length(62.5μm)10m | | |
| 18 | 1 | Length (Copper) | 00 | Not compliant |
| 19 | 1 | Reserved | 00 | |
| 20-35 | 16 | Vendor name | 57 54 44 20 20 20 20 20 | "WTD"(ASCII) |

| | | | | |
|----------------------------------|-----|-----------------|-------------------------|--|
| | | | 20 20 20 20 20 20 20 20 | |
| 36 | 1 | Reserved | 00 | |
| 37-39 | 3 | Vendor OUI | 00 00 00 | |
| 40-55 | 16 | Vendor PN | | Transceiver part number RXM139-401 etc |
| 56-59 | 4 | Vendor rev | 33 2E 30 20 | 3.0 |
| 60-61 | 2 | Wavelength | | Transceiver wavelength |
| 62 | 1 | Reserved | 00 | |
| 63 | 1 | CC_BASE | Check Sum (Variable) | Check code for Base ID Fields |
| EXTENDED ID FIELDS | | | | |
| 64-65 | 2 | Options | 00 1A | TX_DISABLE, TX_FAULT and Loss of Signal implemented. |
| 66 | 1 | BR,max | 00 | |
| 67 | 1 | BR,min | 00 | |
| 68-83 | 16 | Vendor SN | 42 30 30 39 38 32 32 20 | Serial Number of transceiver (ASCII). For example "B009822". |
| 84-91 | 8 | Date code | 30 32 31 30 30 35 20 20 | Manufactory date code. For example "021005". |
| 92-94 | 3 | Reserved | 00 00 00 | |
| 95 | 1 | CC_EXT | Check Sum (Variable) | Check sum for Extended ID Field. |
| VENDOR SPECIFIC ID FIELDS | | | | |
| 96-127 | 32 | Vendor Specific | Read only | Depends on customer information |
| 128-255 | 128 | Reserved | Read only | Filled by zero |

Pin Description



As Viewed Through Top of Board

| Pin | Name | Function/Description | Engagement order | Notes |
|-----|----------|------------------------------|------------------|-------|
| 1 | VeeT | Transmitter Ground | 1 | |
| 2 | TX Fault | Transmitter Fault Indication | 3 | 1 |

| | | | | |
|----|-------------|---|---|---|
| 3 | TX Disable | Transmitter Disable-Module disables on high or open | 3 | 2 |
| 4 | MOD-DEF2 | Module Definition 2-Two wire serial ID interface | 3 | 3 |
| 5 | MOD-DEF1 | Module Definition 1-Two wire serial ID interface | 3 | 3 |
| 6 | MOD-DEF0 | Module Definition 0-Two wire serial ID interface | 3 | 3 |
| 7 | Rate Select | Not Connected | 3 | |
| 8 | LOS | Loss of Signal | 3 | 4 |
| 9 | VeeR | Receiver Ground | 1 | |
| 10 | VeeR | Receiver Ground | 1 | |
| 11 | VeeR | Receiver Ground | 1 | |
| 12 | RD- | Inverse Received Data out | 3 | 5 |
| 13 | RD+ | Received Data out | 3 | 5 |
| 14 | VeeR | Receiver Ground | 1 | |
| 15 | VccR | Receiver Power ---- +3.3V±5% | 2 | 6 |
| 16 | VccT | Transmitter Power ---- +3.3 V±5% | 2 | 6 |
| 17 | VeeT | Transmitter Ground | 1 | |
| 18 | TD+ | Transmitter Data In | 3 | 7 |
| 19 | TD- | Inverse Transmitter Data In | 3 | 7 |
| 20 | VeeT | Transmitter Ground | 1 | |

Note1: TX Fault is open collector/drain output which should be pulled up externally with a 4.7K- 10KΩ resistor on the host board to supply $V_{ccT}+0.3V$ or $V_{ccR}+0.3V$. When high, this output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to <math><0.8V</math>.

Note2: TX Disable input is used to shut down the laser output per the state table below. It is pulled up within the module with a 4.7-10K resistor.

| | |
|------------------------|----------------------|
| Low (0-0.8V): | Transmitter on |
| Between (0.8V and 2V): | Undefined |
| High (2.0-VccT): | Transmitter Disabled |
| Open: | Transmitter Disabled |

Note3: Mod-Def 0, 1, 2. These are the module definition pins. They should be pulled up with a 4.7-10K resistor on the host board to supply less than $V_{ccT}+0.3V$ or $V_{ccR}+0.3V$.

Mod-Def 0 is grounded by the module to indicate that the module is present.

Mod-Def 1 is clock line of two wire serial interface for optional serial ID.

Mod-Def 2 is data line of two wire serial interface for optional serial ID.

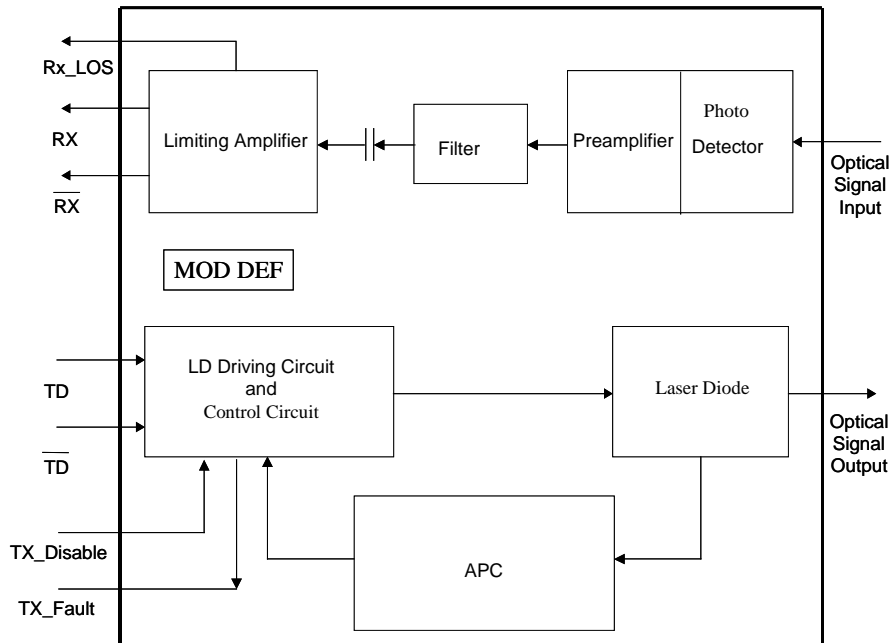
Note4: LOS (Loss of signal) is an open collector/drain output which should be pulled up externally with a 4.7-10K resistor on the host board to supply $V_{ccT}+0.3V$ or $V_{ccR}+0.3V$. When high, this output indicates the received optical power is below the worst case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to <math><0.8V</math>.

Note5: RD-/+: These are the differential receiver outputs. They are AC coupled 100Ω differential lines which should be terminated with 100Ω differential at the user SERDES. The AC coupling is done inside the module and thus not required on the host board.

Note6: VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V±5% at the SFP connector pin. The in-rush current will typically be no more than 30mA above steady state supply current after 500ns.

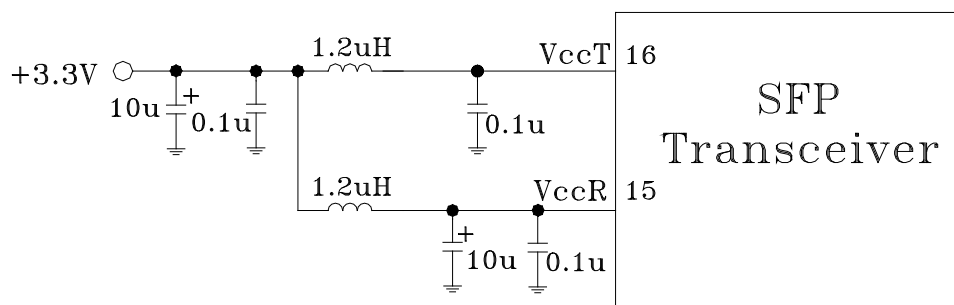
Note7: TD-/+: These are the differential transmitter inputs. They are AC coupled differential lines with 100Ω differential termination inside the module. The AC coupling is done inside the module and is thus not required on host board.

Block Diagram

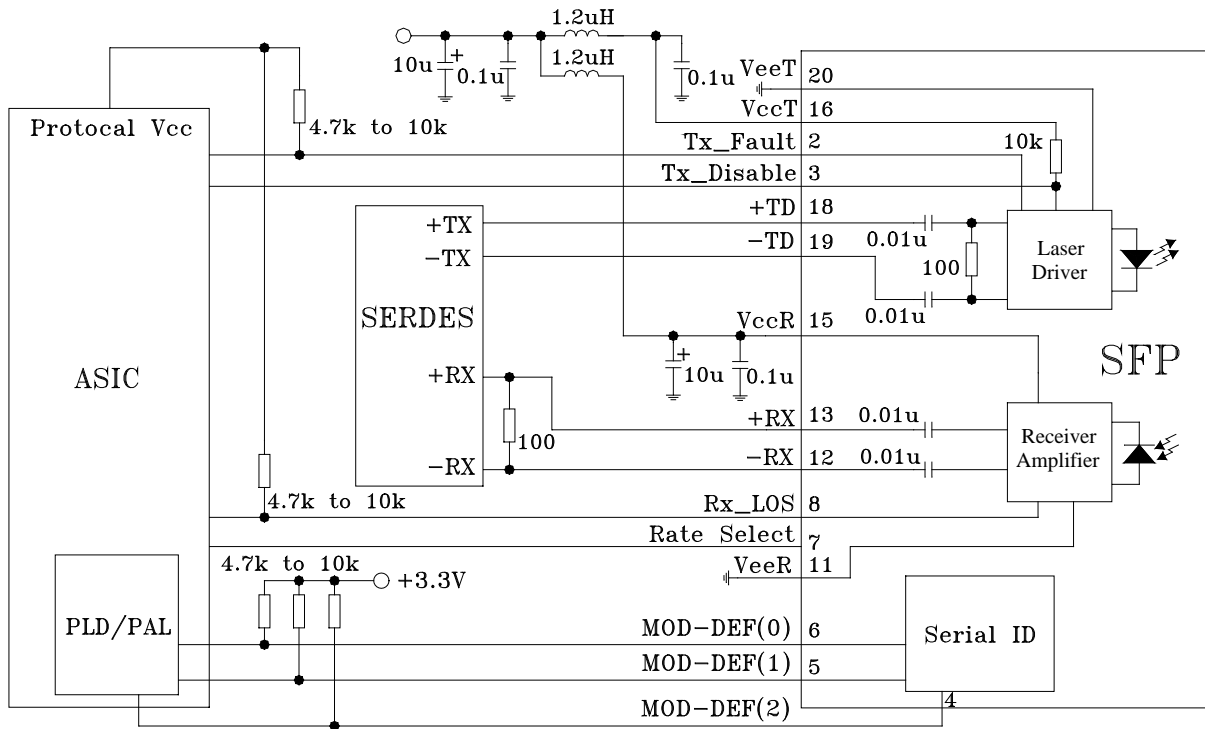


Required Host Board Components

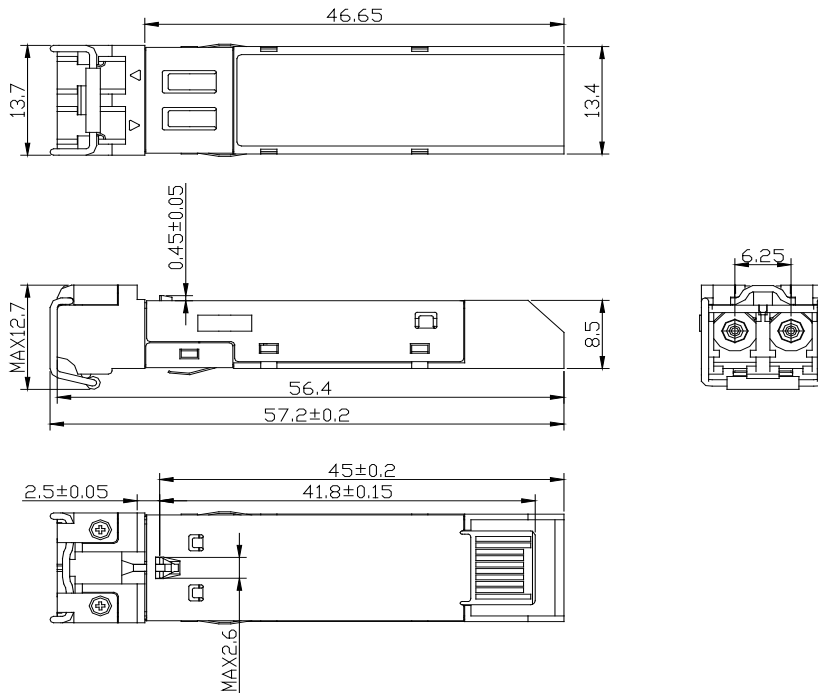
The MSA power supply noise rejection filter is required on the host PCB to meet data sheet performance. The MSA filter incorporates an inductor which should be rated 400mADC and 1Ω serial resistance or better. It should not be replaced with a ferrite. The required filter is illustrated in Figure 3. The MSA also specifies that 4.7K to 10KΩ pull-up resistors for TX_FAULT, LOS, and MOD_DEF0,1,2 are required on the host PCB. Figure is the suggested transceiver/host interface.



Typical Application Circuit

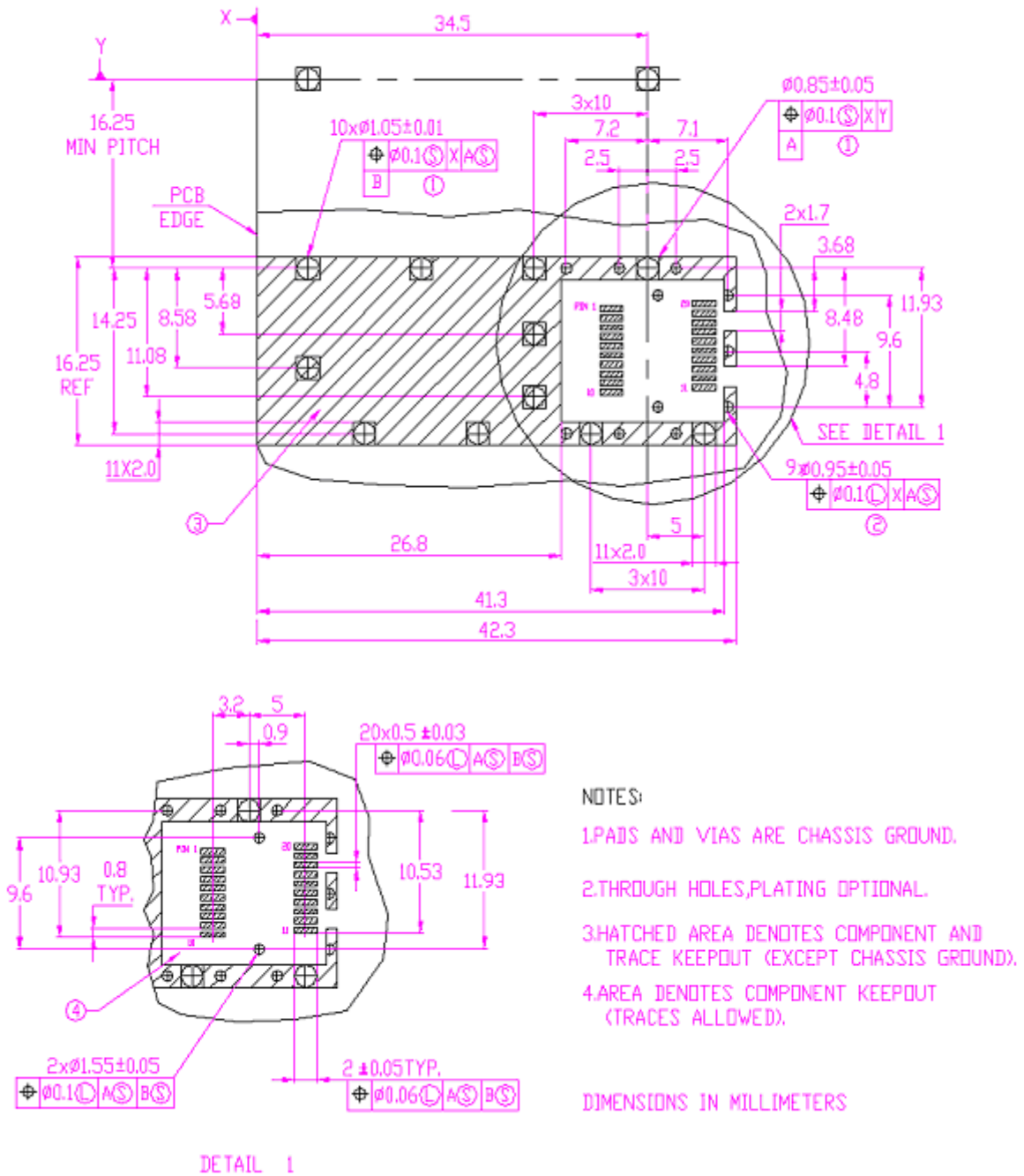


Package Outline (unit: mm)



Unit: mm
Unspecified Tolerance: ±0.1mm

PCB layout recommendation



Regulatory Compliance

| Feature | Test Method | Performance |
|---------|---------------------|----------------|
| RoHS | BS EN 1122: 2001 | Pb < 1000ppm |
| | US EPA METHOD 3050B | Cr6+ < 1000ppm |
| | US EPA METHOD 3052 | Hg < 1000ppm |
| | US EPA METHOD 3060A | PBB < 1000ppm |

| | | | |
|--|---|---|----------|
| | | PBDE | <1000ppm |
| | | Cd | <100ppm |
| Electrostatic Discharge (ESD) to the Electrical Pins | MIL-STD-883E Method 3015.7 | Class 1 (>1.5kV) – Human Body Model | |
| Electrostatic Discharge (ESD) Immunity | IEC61000-4-2 | Class 2(>4.0kV) | |
| Electromagnetic Interference (EMI) | CISPR22 ITE Class B FCC Class B CENELEC EN55022 VCCI Class 1 | Comply with standard | |
| Immunity | IEC61000-4-3 Class 2 | Typically show no measurable effect from a 3 V/m field swept from 80 to 1000MHz applied to the transceiver without a chassis enclosure. | |
| Eye Safety | FDA CDRH 21-CFR 1040 Class 1 NO.:0322110-02 UL NO.:E239070 | | |

Ordering information

| Part No. | Specifications | | | | | | | | | | Application |
|-----------------|----------------|------|------------|---------------|-------|--------|---------|-------|--------|--|-------------|
| | Pack | Rate | Tx | Pout | Rx | S | Top | Reach | others | | |
| RTXM139-403-C10 | SFP | 155M | 1310nm FP | -23.5~ -14dBm | PIN < | -31dBm | -10~70℃ | 2km | RoHS | | - |
| RTXM139-403 | SFP | 155M | 1310nm FP | -15 ~ -8dBm | PIN < | -23dBm | -10~70℃ | 2km | RoHS | | SDH I-1 |
| RTXM139-401 | SFP | 155M | 1310nm FP | -15 ~ -8dBm | PIN < | -31dBm | -10~70℃ | 15km | RoHS | | SDH S-1.1 |
| RTXM139-501 | SFP | 155M | 1550nm DFB | -15 ~ -8dBm | PIN < | -31dBm | -10~70℃ | 15km | RoHS | | SDH S-1.2 |

*: The product marked with * is not available at present.

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