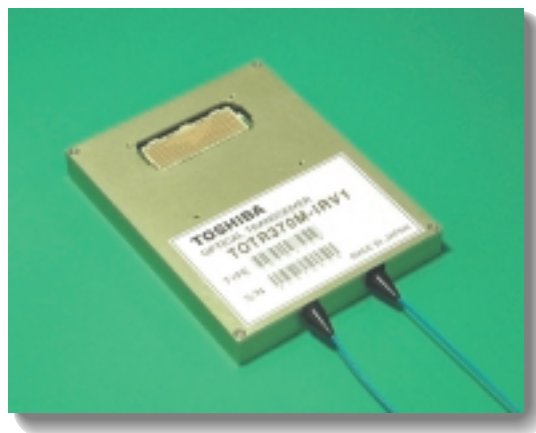


# Optical Communication Devices

## 10 Gb/s Optical Transponder

### TOTR370M-IR Series



#### APPLICATION

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- SONET / SDH (OC-192 / STM-64) applications

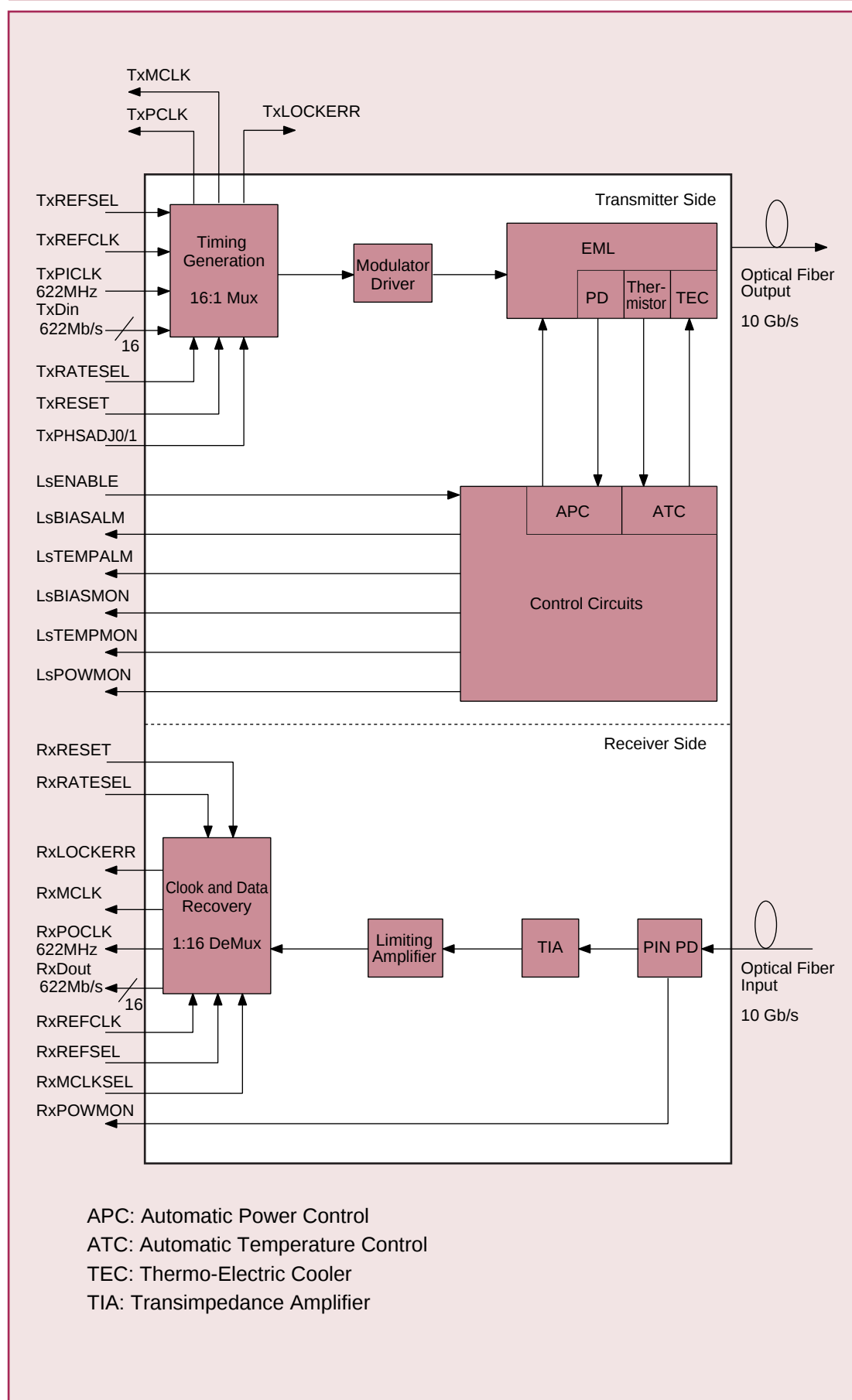
#### FEATURES

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- 10 Gb/s optical transceiver with 16 Channel Mux and DeMux
- Differential LVDS 622 Mb/s data and 622 MHz clock interface
- Optical input power range:  $-17$  dBm (typ) to  $0$  dBm (@ BER =  $10^{-12}$ )
- Optical output power range:  $-4$  dBm (typ) to  $-2$  dBm /  $-0.5$  dBm to  $+1.5$  dBm
- Target distance: 25 km/40 km
- Tc:  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$
- Power supply:  $+5.0$  V,  $+3.3$  V and  $-5.2$  V
- Package size: 114 x 88.9 x 13.4 mm

## TOTR370M-IR Series

### BLOCK DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

| Item                        | Ratings                         | Unit |
|-----------------------------|---------------------------------|------|
| Storage temperature         | −40 to +85                      | °C   |
| Input data signal voltage   | GND−0.5 to V <sub>DD</sub> +0.5 | V    |
| Input optical peak power    | +3                              | dBm  |
| Input optical average power | 0                               | dBm  |
| Positive supply 1 voltage   | 0 to 6                          | V    |
| Positive supply 2 voltage   | −0.5 to +3.8                    | V    |
| Negative supply voltage     | −6.5 to +0.3                    | V    |

## ELECTRICAL AND OPTICAL CHARACTERISTICS

### Operating Temperature

| Item                             | Min | Typ. | Max | Unit |
|----------------------------------|-----|------|-----|------|
| Operating case temperature range | 0   | –    | +70 | °C   |

### Optical Characteristics

| Item                                     | Min            | Typ. | Max  | Unit  |
|------------------------------------------|----------------|------|------|-------|
| Target distance                          | TOTR370M-IRV1A | –    | 25   | km    |
|                                          | TOTR370M-IRV1B | –    | 40   |       |
|                                          | TOTR370M-IRV1C | –    | 40   |       |
| Dispersion                               | TOTR370M-IRV1A | –    | 500  | ps/nm |
|                                          | TOTR370M-IRV1B | –    | 800  |       |
|                                          | TOTR370M-IRV1C | –    | 800  |       |
| Operating wavelength range               | 1530           | –    | 1565 | nm    |
| <b>Transmitter</b>                       |                |      |      |       |
| Spectral Width (@ 20 dB down)            | –              | –    | 1.0  | nm    |
| Side mode Suppression Ratio              | 30             | –    | –    | dB    |
| Optical fiber output power               | TOTR370M-IRV1A | −4.0 | −2.0 | dBm   |
|                                          | TOTR370M-IRV1B | −0.5 | +1.5 |       |
|                                          | TOTR370M-IRV1C | −4.0 | −2.0 |       |
| Extinction ratio                         | 8.2            | –    | –    | dB    |
| Optical return loss                      | 30             | –    | –    | dB    |
| <b>Receiver</b>                          |                |      |      |       |
| Sensitivity (@ BER = 10 <sup>−12</sup> ) | –              | −17  | −14  | dBm   |
| Overload                                 | 0              | –    | –    | dBm   |
| Optical return loss                      | 27             | –    | –    | dB    |
| Optical path penalty (@ Target distance) | –              | –    | 2    | dB    |

### Electrical Power Supplies

| Item                      | Symbol          | Min    | Typ. | Max    | Unit |
|---------------------------|-----------------|--------|------|--------|------|
| Positive supply 1 voltage | V <sub>CC</sub> | +4.75  | +5.0 | +5.25  | V    |
| Positive supply 1 current | I <sub>CC</sub> | –      | –    | 250    | mA   |
| Positive supply 2 voltage | V <sub>DD</sub> | +3.135 | +3.3 | +3.465 | V    |
| Positive supply 2 current | I <sub>DD</sub> | –      | –    | 2500   | mA   |
| Negative supply voltage   | V <sub>EE</sub> | −5.4   | −5.2 | −5.0   | V    |
| Negative supply current   | I <sub>EE</sub> | –      | –    | 500    | mA   |

### Electrical Input and Output Signals (Digital Signal Characteristics)

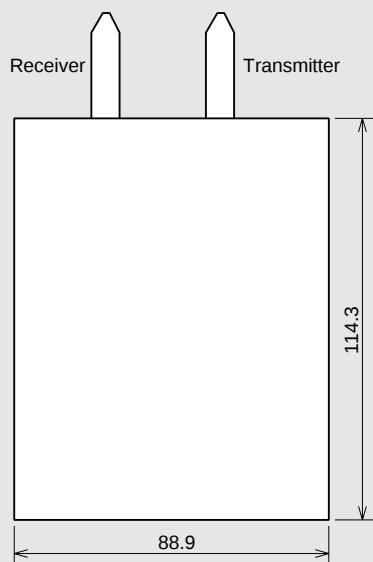
| Item                     | Min                  | Typ. | Max             | Unit |
|--------------------------|----------------------|------|-----------------|------|
| Alam output high level   | V <sub>DD</sub> −0.5 | –    | V <sub>DD</sub> | V    |
| Alam output low level    | GND                  | –    | 0.5             | V    |
| Control input high level | V <sub>DD</sub> −1.0 | –    | V <sub>DD</sub> | V    |
| Control input low level  | GND                  | –    | 1.0             | V    |

### Electrical Input and Output Signals (Analog Signal Characteristics)

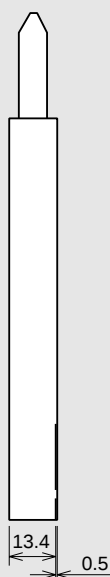
| Item                                         | Symbol    | Min  | Typ. | Max  | Unit  |
|----------------------------------------------|-----------|------|------|------|-------|
| Input power monitor voltage slope for PIN    | RxPOWMON  | 0.8  | –    | 1.26 | V/mW  |
| Normalized laser power monitor voltage       | LsPOWMON  | 0.44 | 0.5  | 0.56 | V     |
| 50% variation of laser power (linear slope)  | –         | –    | 0.25 | –    | V     |
| Laser disable mode                           | –         | −20  | –    | 20   | mV    |
| Laser monitor bias voltage slope             | LsBIASMON | 17.8 | 20   | 22.5 | mV/mA |
| Laser monitor bias offset voltage            | –         | −20  | –    | 20   | mV    |
| Normalized laser temperature monitor voltage | LsTEMPMON | –    | 2.5  | –    | V     |
| Normalized laser temperature monitor slope   | –         | –    | −40  | –    | mV/°C |

## DIMENSIONAL OUTLINE AND PIN ASSIGNMENT

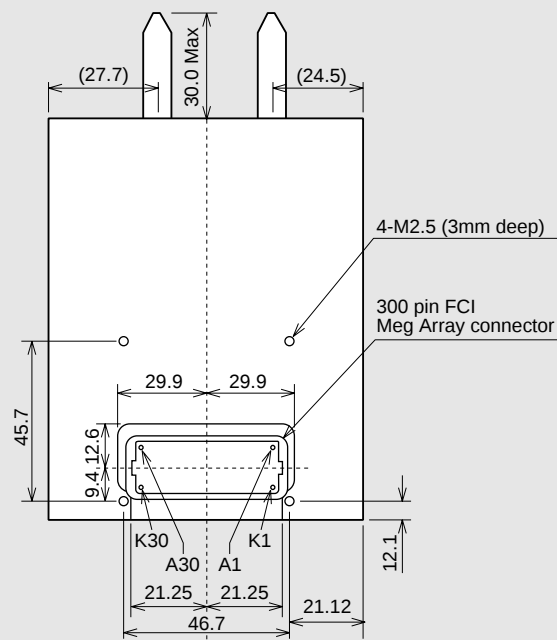
(Unit: mm)



Top view



Side view



Bottom view

### Pin Map Overview

|    | K         | J  | H   | G         | F         | E         | D         | C        | B         | A         |
|----|-----------|----|-----|-----------|-----------|-----------|-----------|----------|-----------|-----------|
| 1  | +5.0V     | NC | GND | RxDout12P | NC        | RxDout8P  | GND       | RxDout4P | GND       | RxDout0P  |
| 2  | +5.0V     | NC | GND | RxDout12N | NC        | RxDout8N  | GND       | RxDout4N | GND       | RxDout0N  |
| 3  | RxRATESEL | NC | NC  | GND       | RxPOWMON  | GND       | NC        | GND      | NC        | GND       |
| 4  | +3.3V     | NC | GND | RxDout13P | +3.3V     | RxDout9P  | GND       | RxDout5P | GND       | RxDout1P  |
| 5  | +3.3V     | NC | GND | RxDout13N | +3.3V     | RxDout9N  | GND       | RxDout5N | GND       | RxDout1N  |
| 6  | RxRESET   | NC | NC  | GND       | NC        | GND       | NC        | GND      | NC        | GND       |
| 7  | NC        | NC | GND | RxDout14P | +3.3V     | RxDout10P | GND       | RxDout6P | GND       | RxDout2P  |
| 8  | NC        | NC | GND | RxDout14N | +3.3V     | RxDout10N | GND       | RxDout6N | GND       | RxDout2N  |
| 9  | NC        | NC | NC  | GND       | NC        | GND       | NC        | GND      | NC        | GND       |
| 10 | -5.2V     | NC | GND | RxDout15P | -5.2V     | RxDout11P | GND       | RxDout7P | GND       | RxDout3P  |
| 11 | -5.2V     | NC | GND | RxDout15N | -5.2V     | RxDout11N | GND       | RxDout7N | GND       | RxDout3N  |
| 12 | NC        | NC | NC  | GND       | NC        | GND       | NC        | GND      | RxMCLKSEL | GND       |
| 13 | -5.2V     | NC | GND | NC        | -5.2V     | RxPOCLKP  | GND       | RxMCLKP  | GND       | RxREFCLKP |
| 14 | -5.2V     | NC | GND | NC        | -5.2V     | RxPOCLKN  | GND       | RxMCLKN  | GND       | RxREFCLKN |
| 15 | NC        | NC | NC  | GND       | RxREFSEL  | GND       | NC        | GND      | RxLOCKERR | GND       |
| 16 | +5.0V     | NC | GND | TxDin12P  | NC        | TxDin8P   | GND       | TxDin4P  | GND       | TxDin0P   |
| 17 | +5.0V     | NC | GND | TxDin12N  | NC        | TxDin8N   | GND       | TxDin4N  | GND       | TxDin0N   |
| 18 | NC        | NC | NC  | GND       | LsBIASMON | GND       | LsPOWMON  | GND      | NC        | GND       |
| 19 | +3.3V     | NC | GND | TxDin13P  | +3.3V     | TxDin9P   | GND       | TxDin5P  | GND       | TxDin1P   |
| 20 | +3.3V     | NC | GND | TxDin13N  | +3.3V     | TxDin9N   | GND       | TxDin5N  | GND       | TxDin1N   |
| 21 | TxRATESEL | NC | NC  | GND       | LsENABLE  | GND       | LsTEMPMON | GND      | NC        | GND       |
| 22 | +3.3V     | NC | GND | TxDin14P  | +3.3V     | TxDin10P  | GND       | TxDin6P  | GND       | TxDin2P   |
| 23 | +3.3V     | NC | GND | TxDin14N  | +3.3V     | TxDin10N  | GND       | TxDin6N  | GND       | TxDin2N   |
| 24 | TxRESET   | NC | NC  | GND       | LsBIASALM | GND       | TxPHSADJ0 | GND      | NC        | GND       |
| 25 | -5.2V     | NC | GND | TxDin15P  | -5.2V     | RxDin11P  | GND       | RxDin7P  | GND       | TxDin3P   |
| 26 | -5.2V     | NC | GND | TxDin15N  | -5.2V     | RxDin11N  | GND       | RxDin7N  | GND       | TxDin3N   |
| 27 | NC        | NC | NC  | GND       | LsTEMPALM | GND       | TxPHSADJ1 | GND      | NC        | GND       |
| 28 | -5.2V     | NC | GND | TxPICKLP  | -5.2V     | TxPICKLP  | GND       | TxMCLKP  | GND       | TxREFCLKP |
| 29 | -5.2V     | NC | GND | TxPICKLN  | -5.2V     | TxPICKLN  | GND       | TxMCLKN  | GND       | TxREFCLKN |
| 30 | NC        | NC | NC  | GND       | TxREFSEL  | GND       | NC        | GND      | TxLOCKERR | GND       |

## Input Controls Truth Tables

|                                                |         |                                                                      |
|------------------------------------------------|---------|----------------------------------------------------------------------|
| RxRATESEL (Pin # K3)                           |         |                                                                      |
| 0                                              |         | FEC rate of 10.664Gb/s and 10.709Gb/s selected                       |
| 1 or NC                                        |         | normal SONET rate of 9.953Gb/s or Ethernet rate of 10.3Gb/s selected |
| RxRESET (Pin # K6)                             |         |                                                                      |
| 0                                              |         | asynchronous DeMux system reset                                      |
| 1 or NC                                        |         | normal operation                                                     |
| RxREFSEL (Pin # F15)                           |         |                                                                      |
| 0                                              |         | selects an RxREFCLK frequency of 155MHz                              |
| 1 or NC                                        |         | selects an RxREFCLK frequency of 622MHz                              |
| RxMCLKSEL (Pin # B12)                          |         |                                                                      |
| 0                                              |         | selects an RxMCLK frequency of 155MHz                                |
| 1 or NC                                        |         | selects an RxMCLK frequency of 622MHz                                |
| TxRATESEL (Pin # K21)                          |         |                                                                      |
| 0                                              |         | FEC rate of 10.664Gb/s and 10.709Gb/s selected                       |
| 1 or NC                                        |         | normal SONET rate of 9.953Gb/s or Ethernet rate of 10.3Gb/s selected |
| TxRESET (Pin # K24)                            |         |                                                                      |
| 0                                              |         | asynchronous Mux system reset                                        |
| 1 or NC                                        |         | normal operation                                                     |
| TxREFSEL (Pin # F30)                           |         |                                                                      |
| 0                                              |         | selects a TxREFCLK frequency of 155MHz                               |
| 1 or NC                                        |         | selects a TxREFCLK frequency of 622MHz                               |
| TxPHSADJ1 (Pin # D27)    TxPHSADJ0 (Pin # D24) |         |                                                                      |
| 0 or NC                                        | 0 or NC | adjusts the phase of the TxPCLK by 0deg                              |
| 0 or NC                                        | 1       | adjusts the phase of the TxPCLK by 90deg                             |
| 1                                              | 0 or NC | adjusts the phase of the TxPCLK by 180deg                            |
| 1                                              | 1       | adjusts the phase of the TxPCLK by 270deg                            |
| LsENABLE (Pin # F21)                           |         |                                                                      |
| 0 or NC                                        |         | normal operation                                                     |
| 1                                              |         | laser disable                                                        |

## Output Alarms Truth Tables

|                       |  |                                |
|-----------------------|--|--------------------------------|
| LsBIASALM (Pin # F24) |  |                                |
| 0                     |  | laser bias alarm active        |
| 1                     |  | normal operation               |
| LsTEMPALM (Pin # F27) |  |                                |
| 0                     |  | laser temperature alarm active |
| 1                     |  | normal operation               |
| RxLOCKERR (Pin # B15) |  |                                |
| 0                     |  | indicates loss of PLL lock     |
| 1                     |  | normal operation               |
| TxLOCKERR (Pin # B30) |  |                                |
| 0                     |  | indicates loss of PLL lock     |
| 1                     |  | normal operation               |

## PRECAUTIONS

- Power supply: Transient electric spike may cause a damage to the laser, the photodiode or IC chips. A surge-free power supply and a slow starter circuit should be used.  
To avoid causing an electrical surge, pins should not be connected or disconnected on the test fixture before turning power off .
- The product should be grounded for obtaining the performance.
- Safety: The laser emits invisible light harmful to the human eyes. Direct viewing should be avoided.

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