

# WaveReady™ SFP Optical Transceivers

## for WRT-740 and WRT-760 Transponders



### Applications

Supports these protocols:

- 100BaseFX Ethernet
- Gigabit Ethernet
- ESCON
- Fibre Channel
- FICON
- OC-3 to OC-48

### Compliance

- GR-253-CORE
- ITU-T G.957
- SFF-8472
- Class 1 laser safe
- EMI emission below FCC Class B
- UL, CDRH, and TUV certified
- SFP MSA
- IEC 60825 and IEC 60950
- Ethernet 802.3
- Fibre Channel FC-PI
- CE Mark
- CTIK approved
- Telcordia GR-468-CORE stress tested
- RoHS (exemptions 7b, 8a)

### Key Features

- **Multi-rate SFP**
  - Multi-rate SFP
  - Fully synchronous optical network/synchronous digital hierarchy (SONET/SDH) complies with all reaches: SR-1, IP-1, IR-2, LR-1, and LR-2
  - Microprocessor-based design fully implements the digital diagnostics monitoring interface (DDMI)
  - Compensates for laser efficiency degradation with automatic output power and extinction ratio control over temperature and lifetime
  - Both PIN and Avalanche Photodiode (APD) versions meet the -27 dB standard reflectance requirement
  - Optical parameters are tuned and optimized over temperature in production testing
- **Ethernet and Fibre Channel SFP**
  - Proven high reliability at <100 FIT
  - Low bit error rate at <10<sup>-12</sup>
  - Provides hot-plug surge protection
  - Advanced fabrication technology
  - Supports Ethernet and/or Fibre Channel data rates
  - Tri-speed versions for stocking simplicity

JDSU WaveReady small form-factor pluggable optical transceivers (SFPs) provide the client-side interface for the WaveReady WRT-740/760-series transponders. The SFP modules are optimized for a wide range of protocols and are available for both single-mode and multimode fiber.

Supported protocols include 100BaseFX Ethernet, Gigabit Ethernet (GigE), Enterprise Systems Connection (ESCON), Fibre Channel, Fiber Connectivity (FICON), and OC-3 to OC-48. Supported data rates range from 125 Mb/s to 2.7 Gb/s.

The bit rate and protocol independence of JDSU transponders and SFPs give service providers the flexibility they need to meet the shifting demands of customers without the need to change installed equipment.

The following SFPs are available:

SFP1: WRT-SFP-S24SB1310  
 SFP2: WRT-SFP-S12SB1310  
 SFP3: WRT-SFP-M20SB0850  
 SFP4: WRT-SFP-S20SB1310  
 SFP5: WRT-SFP-S10SB1310

SFP6: WRT-SFP-S10SB1550  
 SFP7: WRT-SFP-S24SB1550  
 SFP8: WRT-SFP-S24SB1310IR1  
 SFP9: WRT-SFP-S24SBIR2  
 SFP10: WRT-SFP-L3C10SBxx0

## 2

## Compatibility of Client SFPs

| Protocol                       | Bit Rate     | SFPs  |
|--------------------------------|--------------|---|
| <b>Single-mode Fiber (SMF)</b> |              |   |
| 100BaseFX Ethernet             | 125 Mb/s     | SFP1, SFP7, SFP8, SFP9  |
| OC-3 IR-1/STM-1 S-1.1          | 155.52 Mb/s  | SFP1, SFP2, SFP7, SFP8, SFP9  |
| ESCON                          | 200 Mb/s     | SFP1, SFP7, SFP8, SFP9  |
| D1 Video                       | 270 Mb/s     | SFP1, SFP7, SFP8, SFP9  |
| OC-12/STM-4 S-4.1              | 622.08 Mb/s  | SFP1, SFP2, SFP7, SFP8, SFP9  |
| FICON LX                       | 1.0625 Gb/s  | SFP1, SFP7, SFP8, SFP9  |
| 100-SM-LL-L Fibre Channel      | 1.0625 Gb/s  | SFP1, SFP4, SFP5, SFP6, SFP7, SFP8, SFP9                                      |
| 1000BaseLX Gigabit Ethernet    | 1.250 Gb/s   | SFP1, SFP5, SFP6, SFP7, SFP8, SFP9, SFP10                                     |
| 200-SM-LL-I Fibre Channel      | 2.125 Gb/s   | SFP1, SFP4, SFP7, SFP8, SFP9  |
| OC-48/STM-16 I-16              | 2.48832 Gb/s | SFP1, SFP7, SFP8, SFP9  |
| OC-48 FEC                      | 2.7 Gb/s     | SFP1, SFP7, SFP8, SFP9  |
| <b>Multimode Fiber (MMF)</b>   |              |   |
| 100BaseFX Ethernet             | 125 Mb/s     | SFP1 <sup>1</sup> , SFP7 <sup>1</sup> , SFP8 <sup>1</sup> , SFP9 <sup>1</sup> |
| ESCON                          | 200 Mb/s     | SFP1 <sup>1</sup> , SFP7 <sup>1</sup> , SFP8 <sup>1</sup> , SFP9 <sup>1</sup> |
| FICON LX                       | 1.0625 Gb/s  | SFP1 <sup>1</sup> , SFP7 <sup>1</sup> , SFP8 <sup>1</sup> , SFP9 <sup>1</sup> |
| FICON SX                       | 1.0625 Gb/s  | SFP1 <sup>1</sup> , SFP7 <sup>1</sup> , SFP8 <sup>1</sup> , SFP9 <sup>1</sup> |
| 100-M5-SN-I Fibre Channel      | 1.0625 Gb/s  | SFP3  |
| 1000BaseSX Gigabit Ethernet    | 1.250 Gb/s   | SFP3  |
| 200-M5-SN-I Fibre Channel      | 2.125 Gb/s   | SFP3  |

## Optical Specifications

## SFP1: WRT-SFP-S24SB1310

| Customer Interface Side   | Minimum   | Typical           | Maximum   |
|---|---|-------------------|-----------|
| Data rate supported   | 100 Mb/s  | —                 | 2700 Mb/s |
| Output wavelength   | 1266 nm   | 1310 nm           | 1360 nm   |
| Output power level (EOL)  | -10 dBm   | -6.5 dBm          | -3 dBm    |
| Input sensitivity at BER 10 <sup>-12</sup> for 100BaseFX to OC-48 | -18 dBm   | —                 | -3 dBm    |
| Extinction ratio  | 8.2 dB  | 11 dB             | 15 dB     |
| Input fiber types   | Single-mode fiber (SMF) or multimode fiber (MMF) <sup>1</sup> |                   |           |
| Jitter generation—RMS   | —   | 6 mUI RMS         | 7 mUI RMS |
| Optical path penalty  | —   | 1 dB              | —         |
| BER floor   | —   | 10 <sup>-15</sup> | —         |
| Dispersion tolerance  | —   | —                 | 12 ps/nm  |
| Maximum link budget at OC-48                                      | —   | 8 dB              | —         |
| Digital diagnostics capable with receiver input power monitors    | —   | Yes               | —         |

1. Due to the dual media (single-mode and multimode) support of the SFP, fulfillment of this protocol requires a single-mode fiber offset launch mode conditioning patch cord. The offset launch mode conditioning patch cord lowers the launch power by 0.5 dB and incurs a similar penalty on the sensitivity.

## 3

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| <b>Optical Specifications</b> | <b>SFP2: WRT-SFP-S12SB1310</b> |
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| Customer Interface Side  | Minimum   | Typical    | Maximum  |
|--|---|------------|----------|
| Data rate supported  | 155 Mb/s  | —          | 622 Mb/s |
| Output wavelength  | 1261 nm   | 1310 nm    | 1360 nm  |
| Output power level (EOL)                                       | -15 dBm   | -11 dBm    | -8 dBm   |
| Input sensitivity at BER $10^{-10}$ for OC-3 to OC-12          | -23 dBm   | -27 dBm    | —        |
| Extinction ratio   | 8.2 dB  | —          | 15 dB    |
| Input fiber types  | Single-mode fiber (SMF) or multimode fiber (MMF) <sup>1</sup> |            |          |
| Jitter generation—RMS  | —   | 4 mUI RMS  | —        |
| Optical path penalty   | —   | 1 dB       | —        |
| BER floor  | —   | $10^{-15}$ | —        |
| Dispersion tolerance   | —   | —          | 13 ps/nm |
| Maximum link budget at OC-12                                   | —   | 8 dB       | —        |
| Digital diagnostics capable with receiver input power monitors | —   | Yes        | —        |

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| <b>Optical Specifications</b> | <b>SFP3: WRT-SFP-M20SB0850</b> |
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| Customer Interface Side  | Minimum  | Typical         | Maximum |
|--|--|-----------------|---------|
| Data rate supported  | 1.0625 Gb/s (1xFC), 1.25 Gb/s (GigE SX), 2.125 Gb/s (2xFC) |                 |         |
| Output wavelength  | 830 nm   | 850 nm          | 860 nm  |
| Output power level (EOL)                                       | -9.5 dBm   | -4 dBm          | —       |
| Input sensitivity at BER $10^{-12}$                            | -27 dBm  | —               | -4 dBm  |
| Extinction ratio   | —  | 9 dB            | —       |
| Input fiber types  | Multimode fiber (MMF) 62.5/125 and 50/125 $\mu$ m          |                 |         |
| Jitter generation  | —  | 0.26 UI (pk-pk) | —       |
| Maximum link budget at GigE                                    | —  | 17.5 dB         | —       |
| Digital diagnostics capable with receiver input power monitors | —  | No              | —       |

1. Due to the dual media (single-mode and multimode) support of the SFP, fulfillment of this protocol requires a single-mode fiber offset launch mode conditioning patch cord. The offset launch mode conditioning patch cord lowers the launch power by 0.5 dB and incurs a similar penalty on the sensitivity.

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| <b>Optical Specifications</b> | <b>SFP4: WRT-SFP-S20SB1310</b> |
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| Customer Interface Side  | Minimum   | Typical         | Maximum |
|--|---|-----------------|---------|
| Data rate supported  | 1.0625 Gb/s (1xFC), 2.125 Gb/s (2xFC)                         |                 |         |
| Output wavelength  | 1280 nm   | 1310 nm         | 1350 nm |
| Output power level (EOL)                                       | -8 dBm  | —               | -3 dBm  |
| Input sensitivity at BER 10 <sup>-12</sup>                     | -30 dBm   | —               | 0 dBm   |
| Extinction ratio   | —   | 9 dB            | —       |
| Input fiber types  | Single-mode fiber (SMF) or multimode fiber (MMF) <sup>1</sup> |                 |         |
| Jitter generation  | —   | 0.26 UI (pk-pk) | —       |
| Maximum link budget at 2.125 Gb/s                              | —   | 22 dB           | —       |
| Digital diagnostics capable with receiver input power monitors | —   | No              | —       |

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| <b>Optical Specifications</b> | <b>SFP5: WRT-SFP-S10SB1310</b> |
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| Customer Interface Side  | Minimum   | Typical | Maximum |
|--|---|---------|---------|
| Data rate supported  | 1.0625 Gb/s (1xFC), 1.25 Gb/s (GigE LX)                       |         |         |
| Output wavelength  | 1280 nm   | 1310 nm | 1350 nm |
| Output power level (EOL)                                       | -9.5 dBm  | —       | -3 dBm  |
| Input sensitivity at BER 10 <sup>-12</sup>                     | -30 dBm   | —       | 0 dBm   |
| Extinction ratio   | —   | 9 dB    | —       |
| Input fiber types  | Single-mode fiber (SMF) or multimode fiber (MMF) <sup>1</sup> |         |         |
| Jitter generation  | —   | 160 ps  | —       |
| Maximum link budget at 2.125 Gb/s                              | —   | 20.5 dB | —       |
| Digital diagnostics capable with receiver input power monitors | —   | Yes     | —       |

1. Due to the dual media (single-mode and multimode) support of the SFP, fulfillment of this protocol requires a single-mode fiber offset launch mode conditioning patch cord. The offset launch mode conditioning patch cord lowers the launch power by 0.5 dB and incurs a similar penalty on the sensitivity.

## 5

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| <b>Optical Specifications</b> | <b>SFP6: WRT-SFP-S10SB1550</b> |
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| Customer Interface Side  | Minimum   | Typical | Maximum |
|--|---|---------|---------|
| Data rate supported  | 1.0625 (1xFC), 1.25 Gb/s (GigE ZX)                            |         |         |
| Output wavelength  | 1500 nm   | 1550 nm | 1580 nm |
| Output power level (EOL)                                       | 0 dBm   | —       | 5 dBm   |
| Input sensitivity at BER $10^{-12}$                            | -30 dBm   | —       | 0 dBm   |
| Extinction ratio   | —   | 9 dB    | —       |
| Input fiber types  | Single-mode fiber (SMF) or multimode fiber (MMF) <sup>1</sup> |         |         |
| Jitter generation  | —   | 80 ps   | —       |
| Maximum link budget at 2.125 Gb/s                              | —   | 30 dB   | —       |
| Digital diagnostics capable with receiver input power monitors | —   | Yes     | —       |

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| <b>Optical Specifications</b> | <b>SFP7: WRT-SFP-S24SB1550</b> |
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| Customer Interface Side  | Minimum   | Typical    | Maximum    |
|--|---|------------|------------|
| Data rate supported  | 155 Mb/s  | —          | 2700 Mb/s  |
| Output wavelength  | 1500 nm   | 1550 nm    | 1580 nm    |
| Output power level (EOL)                                       | -1 dBm  | 0.5 dBm    | 2 dBm      |
| Input sensitivity at BER $10^{-12}$ for OC-48                  | -28 dBm   | -32 dBm    | —          |
| Extinction ratio   | 8.2 dB  | 10 dB      | 12 dB      |
| Input fiber types  | Single-mode fiber (SMF) or multimode fiber (MMF) <sup>1</sup> |            |            |
| Jitter generation – RMS  | —   | 6 mUI RMS  | 7 mUI RMS  |
| Optical path penalty   | —   | 2 dB       | —          |
| BER floor  | —   | $10^{-15}$ | —          |
| Dispersion tolerance   | —   | —          | 1600 ps/nm |
| Maximum link budget at OC-48                                   | —   | 27 dB      | —          |
| Digital diagnostics capable with receiver input power monitors | —   | Yes        | —          |

1. Due to the dual media (single-mode and multimode) support of the SFP, fulfillment of this protocol requires a single-mode fiber offset launch mode conditioning patch cord. The offset launch mode conditioning patch cord lowers the launch power by 0.5 dB and incurs a similar penalty on the sensitivity.

## 6

## Optical Specifications

## SFP8: WRT-SFP-S24SB1310IR1

| Customer Interface Side  | Minimum   | Typical    | Maximum   |
|--|---|------------|-----------|
| Data rate supported  | 155 Mb/s  | —          | 2700 Mb/s |
| Output wavelength  | 1260 nm   | 1310 nm    | 1360 nm   |
| Output power level (EOL)                                       | -4 dBm  | -2.5 dBm   | -1 dBm    |
| Input sensitivity at BER $10^{-12}$ for OC-48                  | -18 dBm   | —          | 0 dBm     |
| Extinction ratio   | 8.2 dB  | 10.5 dB    | 14 dB     |
| Input fiber types  | Single-mode fiber (SMF) or multimode fiber (MMF) <sup>1</sup> |            |           |
| Jitter generation—RMS  | —   | 6 mUI RMS  | 7 mUI RMS |
| Optical path penalty   | —   | 1 dB       | —         |
| BER floor  | —   | $10^{-15}$ | —         |
| Maximum link budget at OC-48                                   | —   | 14 dB      | —         |
| Digital diagnostics capable with receiver input power monitors | —   | Yes        | —         |

## Optical Specifications

## SFP9: WRT-SFP-S24SBIR2

| Customer Interface Side  | Minimum   | Typical    | Maximum   |
|--|---|------------|-----------|
| Data rate supported  | 155 Mb/s  | —          | 2700 Mb/s |
| Output wavelength  | 1430 nm   | 1550 nm    | 1580 nm   |
| Output power level (EOL)                                       | -4 dBm  | -2.5 dBm   | -1 dBm    |
| Input sensitivity at BER $10^{-12}$ for OC-48                  | -18 dBm   | —          | 0 dBm     |
| Extinction ratio   | 8.2 dB  | 10 dB      | 12 dB     |
| Input fiber types  | Single-mode fiber (SMF) or multimode fiber (MMF) <sup>1</sup> |            |           |
| Jitter generation—RMS  | —   | 6 mUI RMS  | 7 mUI RMS |
| Optical path penalty   | —   | 1 dB       | —         |
| BER floor  | —   | $10^{-15}$ | —         |
| Dispersion tolerance   | —   | —          | 800 ps/nm |
| Maximum link budget at OC-48                                   | —   | 14 dB      | —         |
| Digital diagnostics capable with receiver input power monitors | —   | Yes        | —         |

1. Due to the dual media (single-mode and multimode) support of the SFP, fulfillment of this protocol requires a single-mode fiber offset launch mode conditioning patch cord. The offset launch mode conditioning patch cord lowers the launch power by 0.5 dB and incurs a similar penalty on the sensitivity.

## 7

## Optical Specifications

## SFP10: WRT-SFP-L3C10SBxx0 (xx=47, 49, 51, 53, 55, 57, 59, or 61) GigE CWDM

| Customer Interface Side   | Minimum   | Typical    | Maximum   |
|---|---|------------|-----------|
| Data rate supported   | —   | 1.250 Gb/s | —         |
| Output wavelength CWDM Channel 1 to 8,<br>center wavelength every 20 nm | 1471 nm   | —          | 1611 nm   |
| Output power level (EOL)  | 0 dBm   | 2.0 dBm    | 4.0 dBm   |
| Input sensitivity at BER $10^{-10}$                                     | -23 dBm   | —          | —         |
| Extinction ratio  | 9.0 dB  | —          | —         |
| Input fiber types   | Single-mode fiber (SMF) or multimode fiber (MMF) <sup>1</sup> |            |           |
| Jitter generation—RMS   | —   | —          | 7 mUI RMS |
| Optical path penalty  | —   | —          | 1 dB      |
| BER floor   | —   | $10^{-15}$ | —         |
| Maximum link budget at GigE   | —   | 14 dB      | —         |
| Digital diagnostics capable with receiver input power monitors          | —   | Yes        | —         |

1. Due to the dual media (single-mode and multimode) support of the SFP, fulfillment of this protocol requires a single-mode fiber offset launch mode conditioning patch cord. The offset launch mode conditioning patch cord lowers the launch power by 0.5 dB and incurs a similar penalty on the sensitivity.

**Ordering Information**

For more information on WaveReady or other products and their availability, please contact your local JDSU account manager or JDSU directly at 1-800-498-JDSU (5378) in North America and +800-5378-JDSU worldwide or via e-mail at customer.service@jdsu.com.

| <b>Product Code</b>  | <b>Description</b>   |
|----------------------|--|
| WRT-SFP-S24SB1310    | SFP1: OC-48, multi-rate, SR-1, 1310 nm                                   |
| WRT-SFP-S12SB1310    | SFP2: OC-3 to OC-12, SR-1, 1310 nm                                       |
| WRT-SFP-M20SB0850    | SFP3: GigE SX, 1x and 2x FC, tri-speed SR-1 w/o DDML, 850 nm             |
| WRT-SFP-S20SB1310    | SFP4: 1x and 2x FC, LR, 1310 nm  |
| WRT-SFP-S10SB1310    | SFP5: GigE LX, 1xFC, 1310 nm   |
| WRT-SFP-S10SB1550    | SFP6: GigE ZX, 1xFC, 1550 nm   |
| WRT-SFP-S24SB1550    | SFP7: OC-48, multi-rate, LR-2, 1550 nm                                   |
| WRT-SFP-S24SB1310IR1 | SFP8: OC-48, multi-rate, IR-1, 1310 nm                                   |
| WRT-SFP-S24SBIR2     | SFP9: OC-48, multi-rate, IR-2, 1310 nm                                   |
| WRT-SFPL3C10SBxx0    | SFP10: GigE, CWDM Channel 1 to 8, (xx=47, 49, 51, 53, 55, 57, 59, or 61) |