JDS Uniphase

Product Bulletin

50 Mb/s to 2.5 Gb/s Optical Transmitter Module

54TM Series

The JDS Uniphase 54TM series optical transmitter module is designed for use in telecommunication systems and high speed data communications applications. The transmitter is optimized for SONET OC-1, OC-3, OC-12, and OC-48. It is compatible with the multisource agreement (MSA) specification, which defines a uniform package, pin function, and common optical and electrical characteristics.

The 54TM transmitter meets all GR-253-CORE requirements and ITU-T G.957 and G.958 recommendations.

The 54TM features a unique design that uses fewer parts and completely eliminates the thermoelectric cooler, resulting in cost savings and lower power consumption.

Key Features

- Multisource specification compatible
- SONET OC-1, OC-3, OC-12, and OC-48 rates are supported
- Operation at 1310 or 1550 nm
- Uncooled, field proven, isolated distributed feedback (DFB) laser
- -40 to 85 °C operation

Applications

- High speed, long haul fiberoptic links for voice, data, and digital video
- Metropolitan area networks
- Wide area networks

Compliance

- Telcordia GR-253-CORE
- ITU-T G.957 and ITU-T G.958

Optical Specifications[1]

Parameter		54TM-2XYZ (1310 nm)			54TM-3XYZ (1550 nm)		
	Symbol	Minimum	Typical	Maximum	Minimum	Typical	Maximum
ITU-T / SONET			L-16.1/LR-1			L-16.2/LR-2	
Optical budget[2]		10 dB	-	24 dB	10 dB	-	24 dB
Center wavelength	λ_c	1280 nm	1310 nm	1335 nm	1500 nm	1530 nm	1580 nm
Optical output power[3]	Po	-1.5 dBm	0 dBm	2 dBm	-1.5 dBm	0 dBm	2 dBm
Shutdown optical power	Psd	-	-50 dBm	-40 dBm	-	-50 dBm	-40 dBm
Spectral width[4]	$\Delta\lambda$	-	0.3 nm	1 nm	-	0.3 nm	1 nm
Optical eye diagram[5,6]	O_{ED}	According to ITU G.957 and GR-253-CORE					
SMSR		30 dB	-	-	30 dB	-	-
Extinction ratio[7]	ER	8.2 dB	10 dB	-	8.2 dB	9.5 dB	-
Path penalty (dispersion)[8,9]		-	0.2 dB	1 dB	-	1.3 dB	2 dB
Dispersion		-	-	250 ps/nm	-	-	1600 ps/nm
Jitter generation[10]							
Peak-to-peak	J_{TXpp}	-	-	37 mUI	-	-	37 mUI
RMS	J_{TXrms}	-	-	5 mUI	-	-	5 mUI

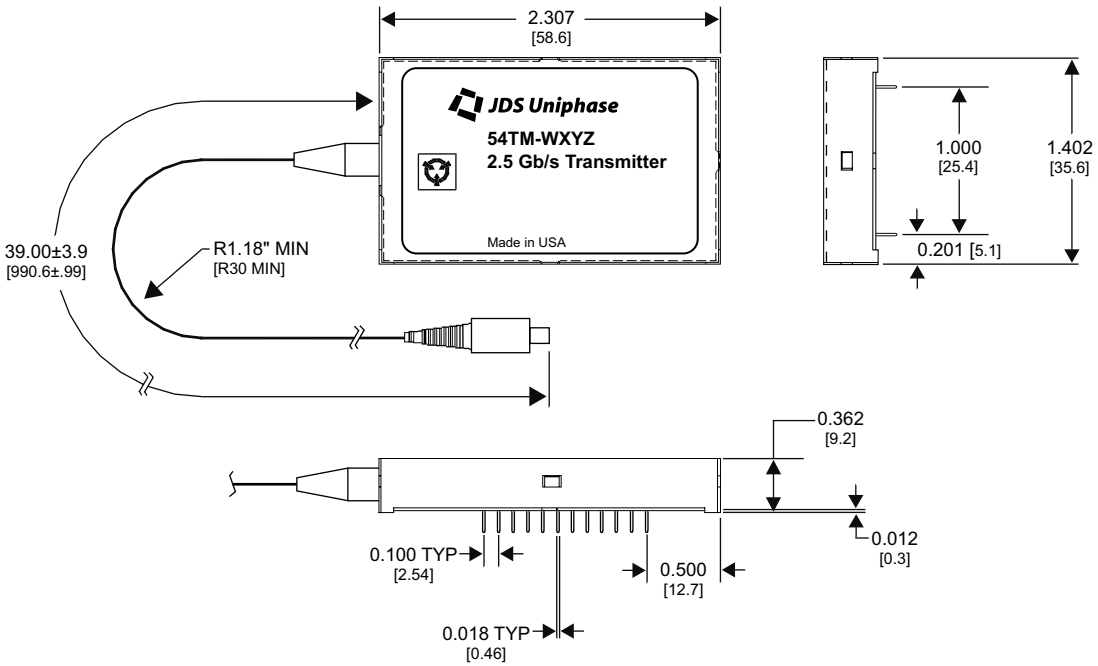
1. All minimum and maximum parameters are specified end-of-life within the overall, relevant operating temperature range.
   The typical values are referenced to 25 °C (nominal power supply) beginning of life.
   The operating conditions are: Vcc = 4.75 to 5.25 V DC
   Vee = 0 V DC
   Line bit rate: 2.48832 Gb/s ±20 ppm
   Line code: SONET STS-48 frame with scrambler, with PRBS23 payload
   Line extinction ratio ≥8.2 dB
   BER ≤$1x10^{-10}$ (the transmitter shall support link performance down to a 10^{-14} BER)
2. The V-16.2 version is adapted to standard 10 to 13 dBm EDFA optical bandwidth.
3. Measured at the connector interface and at end of life.
4. The maximum full width of the central wavelength peak, measured 20 dB down from the maximum amplitude under modulation condition PRBS 2^{23} -1.
5. Measured at end of life, over entire operating temperature, power supply range, and measured into a 25 dB minimum optical return loss.
6. A 5% margin is required in order to guarantee performance at the system level.
7. Measured at the connector interface under modulation condition PRBS 2^{23}-1
8. This note applies only to the 1310 nm version. Path penalty shall include total path dispersion and maximum R point reflectance, (40 km assumed). Measured at center wavelength = 1310 nm. Using 1310 source on non-dispersion shifted fiber at 250 ps/nm, (assuming a DFB laser). Using 1310 source on dispersion shifted fiber at -300 ps/nm, assuming a DFB laser.
9. This note applies only to the 1550 nm version. Path penalty shall include total path dispersion and maximum R point reflectance, (80 km assumed). The penalty when operating on Dispersion-shifted fiber is specified as only 1.0 dB. Measured at center wavelength = 1550 nm. Using 1550 source on non-dispersion shifted fiber at 1600 ps/nm (assuming a DFB laser).
10. Measured into a 25 dB minimum optical return loss. Maximum optical TX jitter allowed by Bellcore and ANSI is .01 UI RMS (4 ps RMS) and 0.1 UI p-p (40 ps p-p). A portion of this jitter requirement has been allocated to the opto transmitter module as noted.
    The maximum RMS jitter contribution from the Optic TX module shall be less than this value. This should be tested with an STS-48 source with less than 2.8 ps RMS jitter to ensure that overall ANSI/Bellcore TX jitter generation requirements are met (with a small additional system margin factored in). Jitter addition is expected to be RMS:
    Jout = [J(STS-48 source)^2 + J(optic TX module)^2]^0.5.
    The maximum peak-to-peak jitter contribution from the Optic TX module shall be less than this value. This should be tested with an STS-48 source with less than 20 ps p-p jitter to ensure that overall ANSI/Bellcore TX jitter generation requirements are met (with a small additional system margin factored in). Jitter addition is expected to be primarily a pattern dependent non-linear algebraic addition, with the highest pp jitter levels measured in the STS-48 section overhead region. Care must be taken to note the jitter signs (polarity) and shape (jitter vs. STS-48 frame position) of the STS-48 source, and the additive jitter due to the optic TX module and any other required test equipment to ensure that this requirement is met. This may require a point-by-point subtraction of the peak jitter vs. time position within an STS line.

Electrical Specifications

Parameters	Symbol	Minimum	Typical	Maximum
Supply voltage[1]		4.75 V DC	5 V DC	5.25 V DC
Power consumption		-	0.8 W	2 W
Input sensitivity data and clock voltage[2,3]	Sv	0.3 V_{p-p}	0.8 V_{p-p}	1 V_{p-p}
Back facet voltage[4]		-	-	1.75 V
Monitor bias voltage slope[4]		-	20 mV/mA	-
Laser degrade alarm (LDA)				
Activated (pin 8)	LDA	0 V DC	-	0.5 V DC
Deactivated[5]		2.4 V DC	-	5.0 V DC
LDA - activation delay	T_{ORen}	-	-	200 ms
LDA - deactivation delay	T_{ORdis}	-	-	400 ms
Shut down command - enable laser (pin 4)[5]	V_E	0 V DC	-	0.8 V DC
Shut down command - disable laser (pin 4)[5]	V_D	2.0 V DC	-	5.0 V DC
Response time to disable laser	t_{dis}	-	-	500 ms
Response time to enable laser	t_{en}	-	-	500 ms
Electrical return loss				
Clock (1 MHz to 2.2 GHz)	IRL(C)	9 dB	-	-
(2.2 GHz to 2.8 GHz)		13 dB	-	-
Data (1 MHz to 1.5 GHz)	IRL(D)	13 dB	-	-
(1.5 MHz to 2.5 GHz)		9 dB	-	-
Clock and data differential skew	Δtin	-	-	40 ps
Clock and data differential voltage (AC coupled into 50 Ω)		0.3 V_{p-p}	-	1.0 V_{p-p}
Clock and data rise time (20% - 80%)	Tr	-	-	150 ps
Clock and data fall time (80% - 20%)	Tf	-	-	150 ps
Data format (scrambled NRZ)				
Clock duty cycle	Dd	40%	50%	60%
Consecutive identical bits	CID	-	-	72 bits
Logic level[5]			TTL compatible	

1. Supply voltage = Vcc-Vee; with Vcc at 5 V, Vee must be at 0 V; with Vee at -5.2 V, Vcc must be at 0 V.
2. Internally AC coupled with 50 Ω internal termination.
3. This sensitivity is achieved by applying at minimum either a 0.3 V_{p-p} signal on one input while the other input is tied to ground or by applying two complementary 0.15 V_{p-p} signals on both inputs.
4. This voltage is measured taking Vee as a reference.
5. With Vcc at 5 V and Vee at 0 V.

Mechanical Outline and Physical Requirements (Specifications in inches [mm] unless otherwise noted.)



Note: FC optical connectors are shown for illustration only.

Ordering Information

For more information on this or other products and their availability, please contact your local JDS Uniphase account manager or JDS Uniphase directly at 800-871-8537 in North America and 800-8735-5378 worldwide or via e-mail at jdsu.sales@jdsu.com.

Sample: 54TM-3G20

54TM- ☐ ☐ ☐ ☐

Code	Laser
2	L-16.1/LR-1
3	L-16.2/LR-2

Code	Connector Type
C	ST/SPC
D	FC/SPC
G	SC/SPC

Code	Class
1	-5 to 75 °C
2	-40 to 85 °C

Code	Adapter
0	OC-48 only
1	With 54TC adapter, 5 V operation
2	With 54 TC adapter, -5 V operation
3	Reserved
4	OC-1, OC-3, OC-12, OC-48 rates

JDS Uniphase

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