Full Band Tunable Transponder

7500 Series

Key Features

- Full C+ or L-band tuning range with 50 GHz channel spacing
- Zero chirp, -0.7 chirp, or +0.7 chirp
- APD or PiN receiver with 50 µs fast transient response
- Built-in SBS suppression dithering with pure phase modulation
- 20 ms fast channel switching
- TxTrace support

Applications

- Universal DWDM transport for Metro, Long-haul and Ultra Long-haul
- Agile optical networks incorporating ROADM technology

Compliance

- Telcordia GR-253, Issue 3
- Telcordia GR-468-CORE
- Telcordia GR-1089-CORE
- OIF-SFI4-01.0
- ITU-T G.691

The flexibility enabled by our 7500 series full band tunable transponders is critical to the rapid deployment of next-generation, IP-based voice, data and video services that are driving new network management challenges for communications service providers. They also support applications ranging from ultra long-haul to metro networks, in a single platform.

The 7500 series 10 Gbps universal transponders are MSA-compliant, full band tunable, long-reach modules incorporating a transmitter and receiver in the same physical package. The module has a 300-pin connector for the electrical interface and two fiber pigtails for optical input and output ports. The module is compliant with ITU G.691 STM-64 L-64.2a and Telcordia GR-253 Issue 3 LR2-c for optical interface; and with OIF-SFI4-01.0 for the electrical interface.

In the transmit direction, the transponder multiplexes sixteen 622 – 710 Mbps electrical signals into a single 9.953 – 11.352 Gbps signal, which is then modulated onto the optical transmitter output. The optical output meets or exceeds the SONET specifications stated in Telcordia GR-253, Issue 3 and draft ITU-T G.691 and G.692. The wavelength of the optical transmitter is user programmable over the full C+ or L-band using commands sent via the I²C™ interface. The transponder module synthesizes a high-frequency clock (9.953 – 11.352 GHz) from either a 1/64 or a 1/16 input clock, depending on user selection.

In the receive direction, the transponder module accepts a 9.953 – 11.32 Gbps optical signal and converts it, using a clock and data recovery circuit, into an electrical equivalent. This electrical signal is then demultiplexed into sixteen 622 – 710 Mbps output signals and its associated clock.

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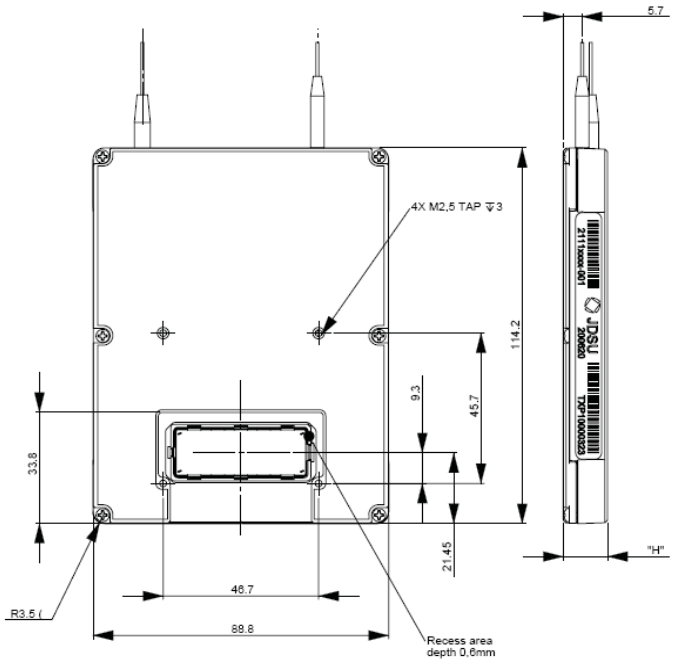
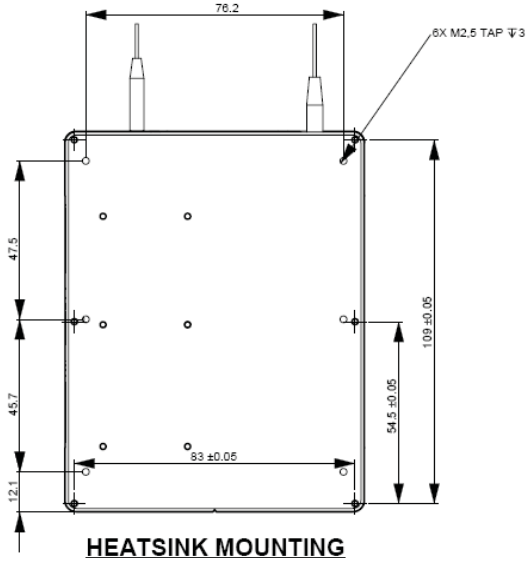
Dimensions Diagram (Specifications in mm unless otherwise noted.)

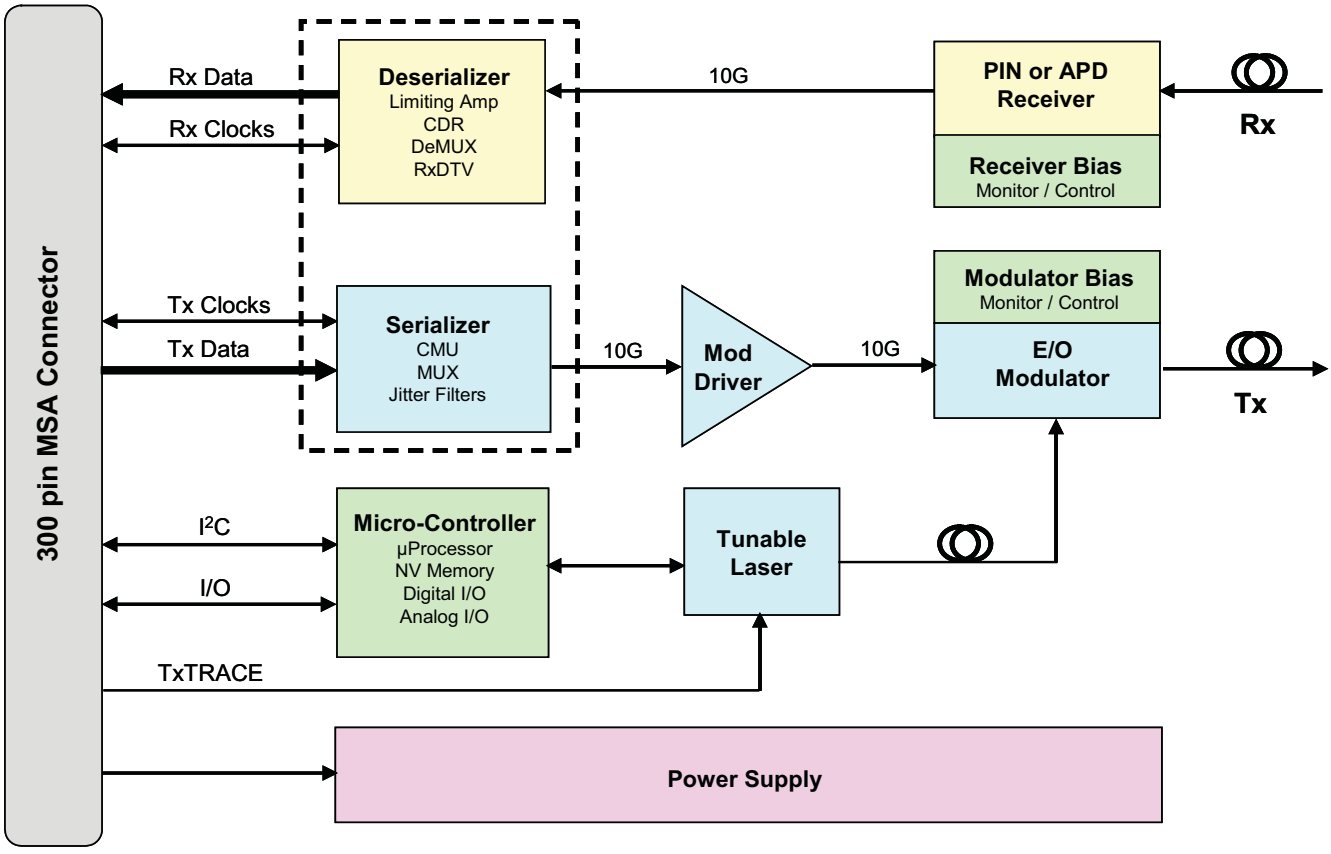


Note:
Module height (dimension "H") is 13.5 mm max. as standard.
Thinner options are available.
Integrated heat sink versions are available.



HEATSINK MOUNTING

Functional Block Diagram



Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum
5 V supply voltage	V_{C5}	-0.3 V	5.5 V
3.3 V supply voltage	V_{C3}	-0.3 V	3.6 V
-5.2 V supply voltage	V_{EE}	0.3 V	-6.0 V
1.8 V supply voltage	V_{C1}	-0.5 V	2.0 V
LVDS input signals		0 V	2.7 V
LVTTL input signals		0 V	3.6 V
Analog input signals		-0.3 V	6.0 V
Operating case temperature range	T_c	-5°C	75°
Storage case temperature range	T_{stg}	-40°C	85°C
Relative humidity (noncondensing)	RH	-	85 %
Minimum fiber-bend radius		-	1 in. (25.4 mm)

Note: Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operations sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Optical Specifications (Transmitter)[1]

Parameter	Symbol	Minimum	Typical	Maximum
C-Band tuning range[2]	λ_C	1528.77 nm	-	1563.86 nm
L-Band tuning range[2]	λ_L	1570.42 nm	-	1610.05 nm
Channel spacing		50 GHz	-	-
Maximum output power at any channel[8]	P_{OUTMAX}	4 dBm	-	-
Total channel power variation over temperature and life		-1.0 dB	-	+1.0 dB
Frequency accuracy over life and temperature[3]		-2.5 GHz	-	+2.5 GHz
Side mode suppression ratio[4]	SMSR	45 dB	50 dB	-
Optical signal to noise ratio[5]	OSNR	50 dB	-	
Relative intensity noise	RIN	-	-	-135 dB/Hz
Laser line width	LW	-	2 MHz	10 MHz
Wavelength tuning time		-	10 ms	20 ms
Output power during tuning		-	-	-40 dBm
Preset chirp 0	•	-0.1	0	+0.1
Preset chirp ± 0.7	| • |	0.6	0.7	0.8
Optical extinction ratio (zero chirp)	ER	12 dB	13 dB	-
Optical extinction ratio (chirped)	ER	11 dB	12 dB	-
Eye crossing[9]		45%	50%	55%
Eye mask margin versus GR253 Issue 3		10%	-	-
SBS suppression FM broadening[6]		100 MHz	-	1200 MHz
SBS suppression step size[6]		-	100 MHz	-
SBS suppression, AM content[6]		-	-	1%

1. All characteristics are through end-of-life, over wavelength range, and over temperature range unless otherwise specified.
2. Wavelength range is larger than 300-pin MSA I²C™ command set. Please refer to JDSU Transponder I²C™ Command Set document.
3. Under locked operation.
4. Ratio of average power in dominant mode to the highest side mode (in a 0.1 nm resolution bandwidth) under closed loop operating conditions
5. Optical signal-to-noise ration (OSNR) is defined as the signal power referenced to the non-coherent noise level in a 0.1 nm bandwidth over 1525 nm – 1565 nm.
6. SBS suppression implemented with a 10 kHz triangle wave on laser phase section, adjustable in 100 MHz steps, minimal amplitude content.
7. EOL at operation temperature range, with BER 1E-12. Spec. applies up to 10.3 Gbps, 1 dB penalty for 10.7 Gbps and 1.5 dB for 11.1 Gbps.
8. Alternative minimum optical power specifications can also be accommodated.
9. Typical configuration. Alternative crossings may be selected to optimize OSNR performance.

Optical Specifications (Receiver)

Parameter	Symbol	Minimum	Typical	Maximum
Receiver sensitivity at 10.7 Gbps (APD)		-	-25 dBm	-24 dBm
Receiver overload (APD)		-5 dBm	-	-
Receiver sensitivity at 10.7 Gbps (PiN)		-	-17 dBm	-16 dBm
Receiver overload at (PiN)		0 dBm	-	-
Optical input wavelength range	$\lambda_{c\text{-}rx}$	1290 nm	-	1609 nm
PMD tolerance at 35 ps DGD (PiN)		-	-	1 dB
PMD tolerance at 30 ps DGD (APD)		-	-	1 dB
Optical return loss		27 dB	-	-
Dispersion tolerance with 2 dB power penalty				
Tx prechirp = -0.7		-	-	1600 ps/nm
Tx prechirp = 0		-	-	± 800 ps/nm

Optical Specificationss (OSNR)

Parameter	Maximum
OSNR tolerance (BOL), APD, Pin -5 dBm to -20 dBm, Tx pre-chirp = -0.7, ER>11dB	
Back-to-back, BER 1E-3, 10.7 G	13 dB
Back-to-back, BER 1E-4, 10. 7G	14 dB
Back-to-back, BER 1E-12, 10.7 G	21 dB
OSNR tolerance (BOL), APD, Pin -8 dBm to -22 dBm, Tx prechirp = 0, ER>13 dB	
Back-to-back, BER 1E-3, 10.7 G	11.2 dB
Back-to-back, BER 1E-4, 10.7 G	12.6 dB
Back-to-back, BER 1E-12, 10.7 G	21 dB
OSNR tolerance (BOL), PiN, Pin -2 dBm to -14 dBm, Tx prechirp = 0, ER>13 dB	
Back-to-back, BER 1E-3, 11.35 G	10.5 dB
Back-to-back, BER 1E-4, 11.35 G	12 dB
Back-to-back, BER 1E-12, 11.35 G	21 dB
OSNR tolerance (BOL), APD, Pin -8 dBm to -20 dBm, Tx pre-chirp = -0.7, ER>11 dB	
1600 ps/nm, BER 1E-3, 10.7 G	16 dB
1600 ps/nm, BER 1E-4, 10.7 G	17 dB
1600 ps/nm, BER 1E-12, 10.7 G	23 dB
OSNR tolerance (BOL), APD, Pin -8 dBm to -22 dBm, Tx prechirp = 0, ER>13 dB	
± 800 ps/nm, BER 1E-3, 10.7 G	13 dB
± 800 ps/nm, BER 1E-4, 10.7 G	14.8 dB
± 800 ps/nm, BER 1E-12, 10.7 G	26 dB
OSNR tolerance (BOL), PiN, Pin -2 dBm to -14 dBm, Tx prechirp = 0, ER>13 dB	
± 800 ps/nm, BER 1E-3, 11.3 5 G	12.5 dB
± 800 ps/nm, BER 1E-4, 11.35 G	14 dB
± 800 ps/nm, BER 1E-12, 11.35 G	23 dB

Electrical Specifications

Parameter	Symbol	Minimum	Typical	Maximum
LVDS input				
Input differential threshold	$\lvert V_{id} \rvert$	200 mV	-	-
Input voltage range	Vi	0.8 V	-	2.4 V
Input differential impedance	R_{in}	80 Ω	100 Ω	120 Ω
LVDS output				
Output differential swing (p–p)	$\lvert V_{od} \rvert$	500	600	120 mV
Output common mode voltage	Vocm	1100	1200	1300 mV
Transmitter parallel data and clock timing		622.08 MHz (9.95328 Gbps)	- -	709.5 MHz (11.352 Gbps)
Receiver parallel data and clock timing		622.08MHz (9.95328Gbps)	- -	709.5 MHz (11.352 Gbps)

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Electrical Pin Assignment

	K	J	H	G	F	E	D	C	B	A
1	P5V0A	*FFU*	FGND	**RxDout12P**	P1V8D	**RxDout8P**	GND	**RxDout4P**	GND	**RxDout0P**
2	P5V0A	*FFU*	FGND	**RxDout12N**	P1V8D	**RxDout8N**	GND	**RxDout4N**	GND	**RxDout0N**
3	RxRATESEL0	RxRATESEL1	*(APDTEMPMON)*	GND	RxPOWMON	GND	I2CAD0	GND	RxDTV	GND
4	P3V3A	NUC	FGND	**RxDout13P**	P3V3D	**RxDout9P**	GND	**RxDout5P**	GND	**RxDout1P**
5	P3V3A	NUC	FGND	**RxDout13N**	P3V3D	**RxDout9N**	GND	**RxDout5N**	GND	**RxDout1N**
6	RxRESET	NUC	DLOOPENB	GND	RxPOWALM	GND	I2CAD1	GND	RxMUTEDout	GND
7	P3V3A	*FFU*	DGND	**RxDout14P**	P3V3D	**RxDout10P**	GND	**RxDout6P**	GND	**RxDout2P**
8	P3V3A	*FFU*	DGND	**RxDout14N**	P3V3D	**RxDout10N**	GND	**RxDout6N**	GND	**RxDout2N**
9	RxMUTEPOCLK	NUC	*FFU*	GND	*(RxSIGMON)*	GND	I2CAD2	GND	RxLCKREF	GND
10	N5V2A	APS_Sense	DGND	**RxDout15P**	N5V2D	**RxDout11P**	GND	**RxDout7P**	GND	**RxDout3P**
11	N5V2A	APS_Set	DGND	**RxDout15N**	N5V2D	**RxDout11N**	GND	**RxDout7N**	GND	**RxDout3N**
12	RxMUTEMCLK	NUC	*FFU*	GND	RxSIGALM	GND	MOD_RESET	GND	RxMCLKSEL	GND
13	N5V2A	*FFU*	DGND	*FFU*	N5V2D	**RxPOCLKP**	GND	RxMCLKP	GND	**RxREFCLKP**
14	N5V2A	RxALMINT	DGND	*FFU*	N5V2D	**RxPOCLKN**	GND	RxMCLKN	GND	**RxREFCLKN**
15	I2CCLOCK	NUC	ALMINT	GND	RxREFSEL	GND	*FFU*	GND	RxLOCKERR	GND
16	P5V0A	TxALMINT	AGND	**TxDin12P**	P1V8D	**TxDin8P**	GND	**TxDin4P**	GND	**TxDin0P**
17	P5V0A	*FFU*	AGND	**TxDin12N**	P1V8D	**TxDin8N**	GND	**TxDin4N**	GND	**TxDin0N**
18	I2CDATA	NUC	*FFU*	GND	LsBIASMON	GND	LsPOWMON	GND	*FFU*	GND
19	*FFU*	ModBIASMON	AGND	**TxDin13P**	P3V3D	**TxDin9P**	GND	**TxDin5P**	GND	**TxDin1P**
20	*FFU*	ModBIASALM	AGND	**TxDin13N**	P3V3D	**TxDin9N**	GND	**TxDin5N**	GND	**TxDin1N**
21	TxRATESEL0	TxRATESEL1	*FFU*	GND	LsENABLE	GND	LsTEMPMON	GND	*FFU*	GND
22	*FFU*	*FFU*	AGND	**TxDin14P**	P3V3D	**TxDin10P**	GND	**TxDin6P**	GND	**TxDin2P**
23	*FFU*	*(LsWAVEALM)*	AGND	**TxDin14N**	P3V3D	**TxDin10N**	GND	**TxDin6N**	GND	**TxDin2N**
24	TxRESET	NUC	*FFU*	GND	LsBIASALM	GND	*FFU*	GND	*FFU*	GND
25	N5V2A	NUC	FGND	**TxDin15P**	*FFU*	**TxDin11P**	GND	**TxDin7P**	GND	**TxDin3P**
26	N5V2A	NUC	FGND	**TxDin15N**	*FFU*	**TxDin11N**	GND	**TxDin7N**	GND	**TxDin3N**
27	TxFIFORES	NUC	LLOOPENB	GND	LsTEMPALM	GND	*FFU*	GND	*FFU*	GND
28	N5V2A	*FFU*	FGND	**TxPICLKP**	*FFU*	**TxPCLKP**	GND	TxMCLKP	GND	**TxREFCLKP**
29	N5V2A	TxTRACE	FGND	**TxPICLKN**	*FFU*	**TxPCLKN**	GND	TxMCLKN	GND	**TxREFCLKN**
30	TxFIFOERR	NUC	TxLINETIMSEL	GND	TxREFSEL	GND	LsPOWALM	GND	TxLOCKERR	GND

- Receiver Power & GND supply
- 669 Mb/s differential Rx signals
- SIGNAL - Rx Alarms / Control

- Transmitter Power & GND supply
- 669 Mb/s differential Tx signals
- SIGNAL - Tx Alarms / Control

- SIGNAL - Common Alarm / Control (including Serial Bus)

- NUC - No User Connection (pin reserved for manufacturer)
- *FFU* - No Internal Connection
- *(SIGNAL)* - No Internal Connection (Standard Configuration) Supported function (Optional Configuration)

Power Supplies

Parameter	Symbol	Supply Voltage			Maximum Current
		Minimum	Typical	Maximum	
Supply voltage[1]					
1.8 V supply voltage	V_{ddi}	1.71 V	1.8 V	1.89 V	1 A
3.3 V supply voltage	V_{ddo}	3.13 V	3.3 V	3.47 V	2 A
5 V supply voltage	V_{cc}	4.75 V	5 V	5.25 V	0.8 A
-5.2 V supply voltage	V_{ee}	-5.46 V	-5.2 V	-4.94 V	1.8 A
Power consumption[2]		-	-	12.0 W	-

1. The transponder meets specification independent of power-up sequence and with broadband noise on power supplies with a frequency range of five to 20 MHz and 75 mVp-p.
2. Steady-state power dissipation.

Physical Specifications

Parameter	Minimum	Typical	Maximum
Package dimensions (W x H x L)		88.9 x 13.46 x 114.3 mm (3.5 x 0.53 x 4.5 in.)	
Minimum fiber bend radius		25.4 mm (1 in.)	
Fiber pigtail length	95 cm (37.4 in.)	100 cm (39.4 in.)	105 cm (41.4 in.)

Module Interface

The transponder interface is compatible with the 300-Pin Transponder MSA I²C™ interface. The I²C™ interface allows for all the options available through the hardware pins (pin mode) to be available through commands (soft mode). Via soft mode commands, the host may set and retrieve the ITU channel, and disable or enable the output. Several monitoring values are available through commands, including output power, laser and transponder temperature, and laser bias current. The host may be informed of an alarm condition through the RxALMINT, TxALMLINT, or ALMINT hardware pins and query the module for alarm status. Inventory information such as vendor, model, part number, transponder type, revisions, and serial number are available. The I²C™ interface will also allow upgrading of all programmable devices.

The Transponder I²C™ Command Set document provides more details about the I²C™ physical interface, as well as the protocol and command set.

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Handling

Because the complete universal transponder module is not hermetically sealed, do not immerse it or spray it with cleaning solutions or solvents. The fiber connector handling/protection (dust) cap and the fiber pigtail materials can deform at temperatures above +85°C.

Reliability

The transponder module is designed to operate within specification with a target FIT rate < 1800 after 20 years, assuming an ambient temperature of 30°C.

Product Configuration

The guide below is used to better understand customer needs when selecting a specific configuration. This is not the same as the part numbers used for ordering.

Product Configuration		75AB-CD-XX	
A	Optical output power	2	+2.5 dBm typical
		5	+5.5 dBm typical
B	Wavelength band	5	Full C-band
		6	Full L-band
C	Receiver	1	APD
		2	PiN
D	Modulator chirp	1	±0.7
		2	0
XX	Connector type	01	FC/UPC
		02	SC/UPC
		03	LC/UPC

Ordering Information

For more information on this or other products and their availability, 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.

Compliance

Environmental

Storage temperature: the transponder module is capable of storage in a -40°C to +85°C environment, without any performance or reliability deficiencies when used. It is in compliance with GR-63-CORE, Section 5.5.1.

Shock and vibration: compliant with GR-63-CORE, Sect. 5.4.2.

Fire spread test: compliant with GR-63-CORE, Sect. 5.2.3

ESD

The electrical input pins shall be protected against ESD to withstand minimum 500 V with appropriate human body model.

Packaging Ground

The module metal case is connected to the frame ground pins and is isolated (100 VDC) from all other signals, including digital and analog ground.

Laser Safety

The 7500 series transponders are classified as Class I per IEC/EN 60825-1/A2:2001.

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