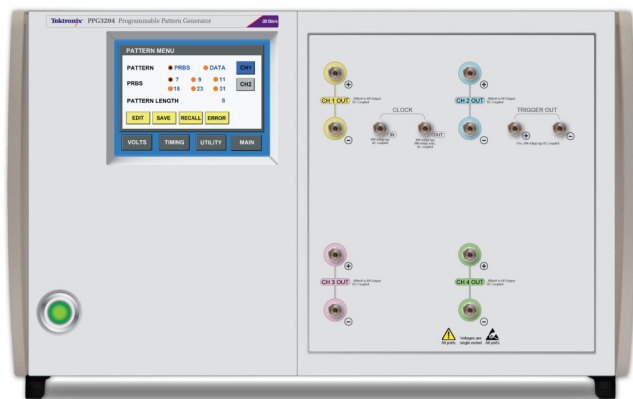


30 Gb/s and 32 Gb/s Programmable Pattern Generator

PPG Series Datasheet



PPG3202 and PPG3204 Programmable Pattern Generators

Features & Benefits

- Available with 1, 2, or 4 output channels of 30 Gb/s or 32 Gb/s (independent data on all channels)
- Aligned data on multi-channel units
- Built-in adjustable low jitter clock source
- DC coupled differential data outputs
- Programmable output amplitude, offset, and crossing point (30Gb/s models only)
- PRBS and user defined patterns
- Adjustable channel phase delay
- Option for built-in jitter insertion
- Front panel touch screen GUI or USB computer control

Output Performance

- Low inherent jitter (typ $R_j < 300$ fs)
- 8 ps typical 20% to 80% rise/fall times (32 Gb/s models only)
- 500 mV fixed output amplitude (32 Gb/s models only)
- 17 ps typical 20% to 80% rise/fall times (30 Gb/s models only)
- 250 mV to 2.0 V output amplitude (30 Gb/s models only)
- -2.0 V to 3.0 V offset window (30 Gb/s models only)
- 35% to 65% programmable crossing point (30 Gb/s models only)

Applications

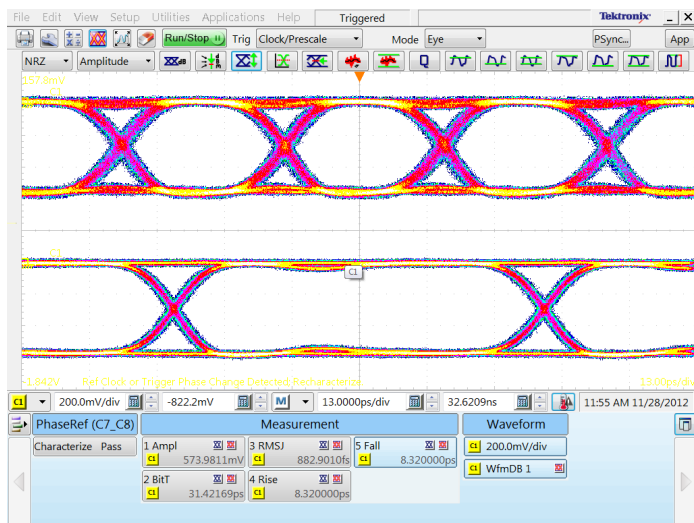
- 25 Gb/s testing for 100 G Ethernet
- DQPSK and DP-QPSK testing
- Semiconductor and component testing

Product Description

The Tektronix PPG line of high-performance pattern generators offer single and multi-channel configurations capable of data rates up to 32 Gb/s. With optional jitter insertion, the PPG line offers a flexible, cost effective and easy to use test solution supporting high speed applications such as 100 Gigabit Ethernet, DP-QPSK testing and a broad range of receiver test applications. The single unit multi-channel configurations provide aligned, pattern-independent data outputs that support testing of crosstalk immunity and multi-channel functionality. The PPG line can be paired with the Tektronix PED line of Error Detector products to provide a complete BER test capability.

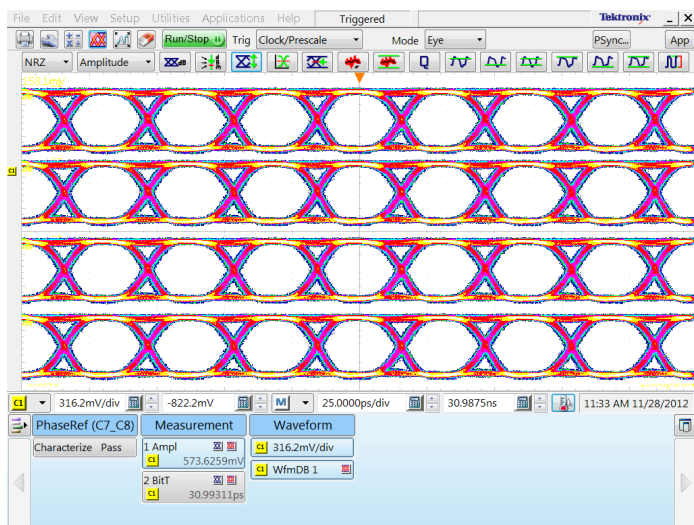
30 Gb/s and 32 Gb/s Programmable Pattern Generator - PPG Series Datasheet

Data rate may be programmed over a broad range of values. (32 Gb/s version shown) Output may be either built-in PRBS patterns or programmed user data patterns.

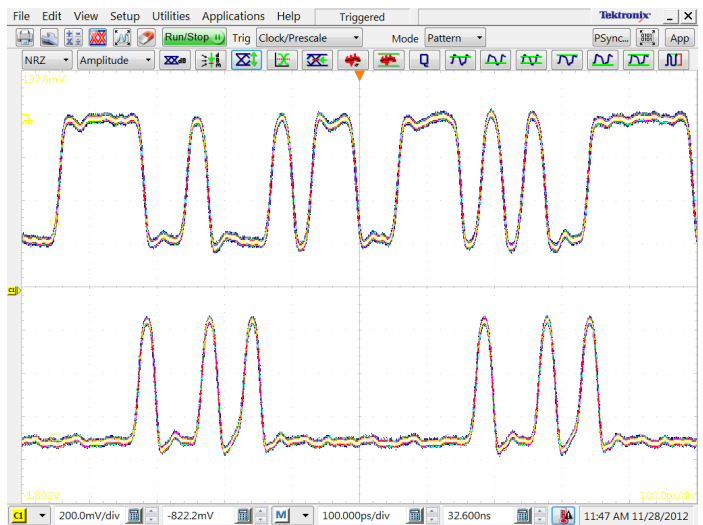


32Gb/s and 14Gb/s programmed data rates

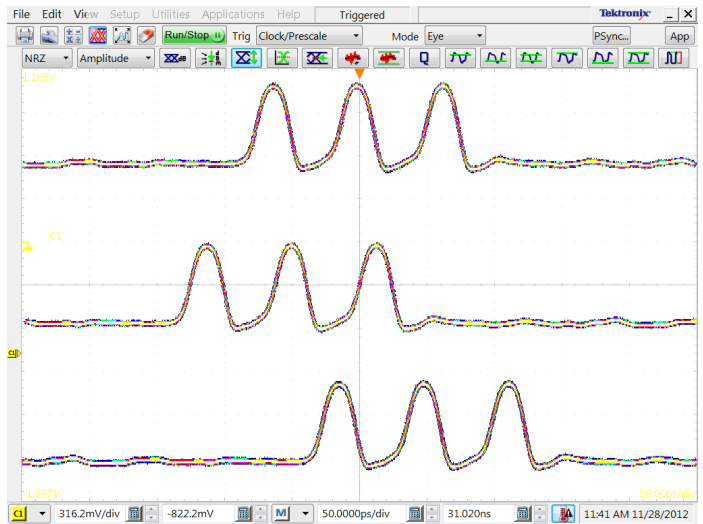
Independently programmable output channels allow comprehensive multi-lane testing. Data output has an adjustable skew/delay range of 100 ps (channel independent). (32 Gb/s version shown)



Four channel independent output data at 32 Gb/s



Built-in PRBS and programmed user data



32 Gb/s custom user data demonstrating programmed data skew values of 0 ps, -50 ps, and +50 ps.

Characteristics

Characteristic	PPG3001 PPG3002 PPG3004	PPG3201 PPG3202 PPG3204	Notes
Amplitude			
Single ended	250 mV to 2.0 V	500 mV typ.	PPG3001, PPG3002, PPG3004: Each positive and negative differential output is independently programmable.
Differential	500 mV to 4.0 V	1.0 V typ.	PPG3201, PPG3202, PPG3204: DC coupled. Each side of the differential pair swings from –500 mV to 0 V. Ground referenced CML. Terminate 50 Ω to ground.
Offset window	–2 V to +3 V		Programmable/adjustable
Termination voltage	–2 V to +3.3 V		Programmable/adjustable
Crossing point adjust range	35% to 65% typ.		Programmable/adjustable
Risetime			
20% to 80%	17 ps typ.	8 ps typ.	
10% to 90%	25 ps typ.	12 ps typ.	
Data output jitter	1 ps _{rms} typ.	900 fs _{rms} typ.	Measured with 2 ⁷ –1 PRBS
Data phase delay adjustment			Phase adjustment range of a given channel output differential pair.
Range	100 ps (\pm 50 ps)	100 ps (\pm 50 ps)	
Resolution	100 fs	100 fs	
Connector type	2.92 mm	2.4 mm	
Output impedance			
Single-ended	50 Ω	50 Ω	
Differential	100 Ω	100 Ω	

Other Outputs

Characteristic	PPG3001 PPG3002 PPG3004	PPG3201 PPG3202 PPG3204	Notes
Clock Output			AC coupled. Single ended. Applicable for internal clock. Amplitude varies with frequency.
Internal clock rate range	15 GHz to 30 GHz	16 GHz to 32 GHz	
Amplitude	600 mV _{p-p} typ.	600 mV _{p-p} typ.	
Jitter	<300 fs _{rms} typ.	<300 fs _{rms} typ.	
Programmable divider	n = 1, 2, 4, 8, 16	n = 1, 2, 4, 8, 16	
Connector type	2.92 mm	2.4 mm	
Trigger			DC coupled. May be programmed as pattern trigger or clock/n (with n = multiples of 64).
Output voltage swing	-500 mV to 0 V	-500 mV to 0 V	
Connector type	SMA	SMA	

Inputs

Characteristic	PPG3001 PPG3002 PPG3004	PPG3201 PPG3202 PPG3204	Notes
External clock input	400 mV _{p-p} typ 800 mV _{p-p} max	400 mV _{p-p} typ 800 mV _{p-p} max	AC coupled
External clock valid range	15 GHz to 30 GHz	16 GHz to 32 GHz	
10 MHz reference input/output	Yes	Yes	BNC connector

Pattern Generator

Characteristic	PPG3001 PPG3002 PPG3004	PPG3201 PPG3202 PPG3204	Notes
Data rate	30 Mb/s to 30 Gb/s	32 Mb/s to 32 Gb/s	Programmable/adjustable
Data rate resolution	10 kb/s	10 kb/s	Accuracy ± 5 ppm
Built-in PRBS patterns	$2^7 - 1 (x^7 + x^6 + 1)$ $2^9 - 1 (x^9 + x^5 + 1)$ $2^{11} - 1 (x^{11} + x^9 + 1)$ $2^{15} - 1 (x^{15} + x^{14} + 1)$ $2^{23} - 1 (x^{23} + x^{18} + 1)$ $2^{31} - 1 (x^{31} + x^{28} + 1)$	$2^7 - 1 (x^7 + x^6 + 1)$ $2^9 - 1 (x^9 + x^5 + 1)$ $2^{11} - 1 (x^{11} + x^9 + 1)$ $2^{15} - 1 (x^{15} + x^{14} + 1)$ $2^{23} - 1 (x^{23} + x^{18} + 1)$ $2^{31} - 1 (x^{31} + x^{28} + 1)$	Independently selected on multi-channel units
User defined pattern depth			Independently programmed (length, data on 2 or 4 channel units)
Single channel unit	4 Mbit	4 Mbit	
2 or 4 channel units	2 Mbit/channel	2 Mbit/channel	
Resolution	1 bit	1 bit	
Pattern output bit shift range	$\pm(2^{30} - 1)$ bits	$\pm(2^{30} - 1)$ bits	Shifts the data pattern. Independent per channel.
Programmable error insertion			Error insertion may be enabled with either single bit error insertion or at a programmable rate.
Single bit errors	Yes	Yes	
Programmable rate errors	10^{-3} to 10^{-15} BER	10^{-3} to 10^{-15} BER	

Jitter Insertion Option (independent jitter sources on each channel)

Characteristic	PPG3001 PPG3002 PPG3004	PPG3201 PPG3202 PPG3204	Notes
Total modulation range			Peak to peak range from all sources
≤10 MHz _{fmod}	150 ps _{p-p}	150 ps _{p-p}	
>10 MHz to 100 MHz _{fmod}	150 ps _{p-p}	60 ps _{p-p}	
Built-in sine source			Programmable from either front panel touch screen GUI or remote control
Frequency range	5 kHz to 100 MHz	5 kHz to 100 MHz	
Amplitude range			
5 kHz to ≤10 MHz _{fmod}	0 to 150 ps _{p-p}	0 to 150 ps _{p-p}	
>10 MHz to 100 MHz _{fmod}	0 to 150 ps _{p-p}	0 to 60 ps _{p-p}	
Accuracy	±10% typ	±10% typ	
Built-in random noise source			Programmable from either front panel touch screen GUI or remote control
Amplitude range	0 to 12.5 ps _{rms}	0 to 5 ps _{rms}	
Accuracy	±10% typ.	±10% typ.	
External modulation input			DC coupled. 3 dB bandwidths. 1 V _{p-p} input equals modulation of 150 ps _{p-p} .
Frequency range	DC to 100 MHz	DC to 100 MHz	
Amplitude range			
≤10 MHz _{fmod}	0 to 150 ps _{p-p}	0 to 150 ps _{p-p}	
>10 MHz to 100 MHz _{fmod}	0 to 150 ps _{p-p}	0 to 60 ps _{p-p}	
Max input	5 V _{p-p}	5 V _{p-p}	

Control Interfaces

Characteristic	PPG3001 PPG3002 PPG3004	PPG3201 PPG3202 PPG3204	Notes
Front panel touch screen GUI	Yes	Yes	Edit all instrument settings
Computer programmable interface	USB TMC	USB TMC	Program all instrument settings

Ordering Information

Models

Item	Description
PPG3001	30 Gb/s Programmable Pattern Generator, 1-channel
PPG3002	30 Gb/s Programmable Pattern Generator, 2-channel
PPG3004	30 Gb/s Programmable Pattern Generator, 4-channel
PPG3201	32 Gb/s Programmable Pattern Generator, 1-channel
PPG3202	32 Gb/s Programmable Pattern Generator, 2-channel
PPG3204	32 Gb/s Programmable Pattern Generator, 4-channel

Options

Instrument Options

Item	Description
Opt. JIT	Built-in Jitter Insertion

Power Plug Options

Item	Description
Opt. A0	US plug, 115V, 60 Hz
Opt. A1	Euro plug, 220V, 50 Hz
Opt. A2	UK plug, 240V, 50 Hz
Opt. A6	Japanese plug, 100V, 110/120V, 60 Hz
Opt. A10	China plug, 50 Hz
Opt. A11	India plug, 50 Hz
Opt. A99	No power cord

User Manual Options

Option	Description
Opt. L0	English Manual



Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.



Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

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