multiLane

Innovation for the next generation

AT4039D

4-channel | 28 Gbaud PAM & NRZ | 200G BERT | Advantest 93K Platform |

4 x 28 Gbd NRZ/PAM-4 BERT | SSPRQ, PRBS13Q, PRBS13Q TX | FEC Estimation KR4/KP4 | SER & MSB/LSB BER | TX and RX Equalizers | Signal SNR and Histogram | ISI Channel Emulator

Summary

The AT line of products is highly integrated for the Advantest V93000 system and fits right underneath the load board, in the cavity of the test head extender. Due to this, the signal path to the DUT is kept extremely short.

The AT line of instruments is made to work for packaged silicon systems as well as for wafer probing and is meant to enable at-speed testing of SerDes, transceivers, amplifiers and other active and passive high-speed digital components. The AT family consists of pattern generators, error detectors and sampling oscilloscopes.
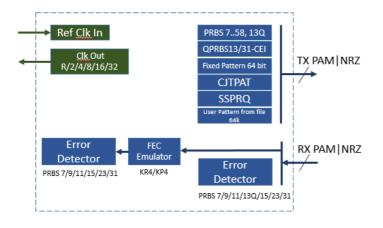
AT4039D

4x28 GBd BERT

Introduction

The AT4039D is a fully featured 200G BERT that can be configured as a 4-channel PAM4 28 GBaud or 4-channel NRZ 28 Gbps lanes.

The receivers support FEC decoding (KS4, KR4 and KP4) and will return the post-FEC BER per channel as well as MSB and LSB BERs and SER within the stream. The receivers also show the eye's Histogram and the channel's SNR over time.

The transmitters Support all standard test patterns mandated by IEEE and OIF such as PRBS13Q, SSPRQ and PRBS31Q.

The user may also program the TX to output a user-defined pattern up to 32 kb long.

The transmit power is adequate for testing up to 10 Km SMF links.

Key Features

Transmit

- Data Rates: 9 – 14.3 and 23 – 29.5 GBd
- Ability to tune the bit rate in steps of 100 kbps and find the RX PLL locking margin.
- Independent control of inner eye levels
- High frequency clock out > 2.4 GHz
- Up to 1.5 Vppd output swing
- Supports Gray coding and polarity inversion

Available patterns are:
- PRBS 7/9/11/13/15/16/23/31/58 and their inverses
- PRBS13Q
- SSPRQ
- Square wave, JP03A/B, CID, JTOL pattern
- Error injection
- 3-tap LUT-based Pre- and Post-emphasis
- 7-tap linear TX FFE
- Amplitude tunable in steps of 1.5mV.
- Separate control to scale the PAM4 signal.
- Programmable channel emulator that emulates any trace loss from 1 to 9dB.

Receive

- Adaptive equalizer and channel IL estimator up to 14 dB (FFE+DFE).
- User-selectable CTLE 0 – 9 dB.
- SNR monitoring over time.
- Eye monitor.
- PAM slicer threshold adjustable.
- Error-detection on following patterns:
  - PRBS 7/9/11/15/16/23/31
  - PRBS13Q and PRBS31Q
- LOS indicators.

General

- LabView sample code
- Python wrapper available

Target Applications

- Production testing of transceivers
- Functional and SI testing.
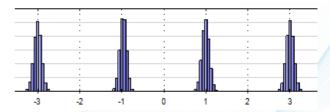- API libraries with documentation
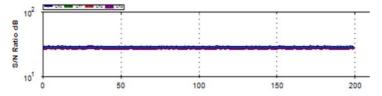

Figure 1: PAM eye histogram
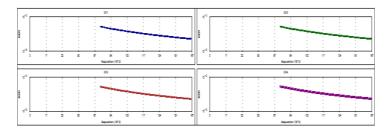
Figure 1: SNR capture over time

Figure 2: Adaptive channel equalization for up to 14dB loss at Nyquist

Figure 3: BER curves of 4 channels

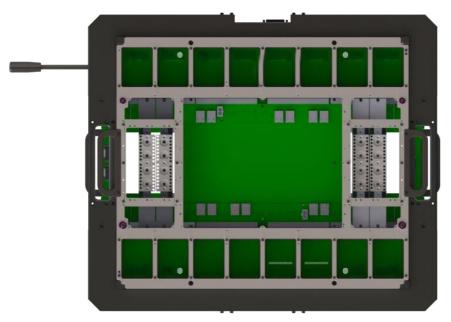Figure 5: AT4039D Pinout. closest to the backplane connector is TX1N

Figure 6: Four ML cassettes mounted in an Advantest V93K HSIO test head extender frame

Electrical Specifications

Parameter	Specifications
Bit Rates	PAM-4: 23 – 29.5 GBaud NRZ: 9 – 14.3G and 23 – 29.5 Gbps
TX Amplitude Differential	0 - 1500 mVpp
Patterns	PRBS 7/9/11/13/15/16/23/31/58 PRBS13Q and SSPRQ Square wave, JP03A, CID JTOL pattern
TX Amplitude Adjustment	Steps of 1.5 mV
Pre- / Post-emphasis Resolution	1000 steps
Equalizing Filter Spacing	1UI
Random Jitter RMS	<230 fS (185fs typical)1
Rise/ Fall Time (20–80%)	16 ps
Coding	Gray coding supported
Output Return Loss up to 10GHz	< -10dB
Output Return Loss (16-25GHz)	< -8dB
Error Detector input range	50 mV– 1200 mV diff.
Input CTLE Dynamic Range	1 - 9 dB
Total DFE/FFE/CTLE Equalization	More than 14 dB
TX/RX connectors	SMPM blind-mate
Reference clock Output	Rate div 8/16/32/165 (<1.2GHz from AT4000L backplane)
Clock out amplitude	1.2 Vpp
Eye monitor resolution	8 bits horizontal across 2UI / 9 bits vertical
Clock Input Range	50 - 550 MHz
Clock Input Amplitude	200 - 1000 mV
Input Impedance	50 Ω
Temperature range	0-75 °C
Power rating	12V, 1.6A (from AT4000L backplane)

PRBS Pattern	Polynomial
7	$x^7 + x^6 + 1$
9 Variant 1	$x^9 + x^4 + 1$
9 Variant 2	$x^9 + x^5 + 1$
11	$x^{11} + x^9 + 1$
13Q	$x^{13} + x^{12} + x^2 + x + 1$
15	$x^{15} + x^4 + 1$
16	$x^{16} + x^5 + x^3 + x^2 + 1$
23	$x^{23} + x^{18} + 1$
31	$x^{31} + x^{28} + 1$
58	$x^{58} + x^{39} + 1$

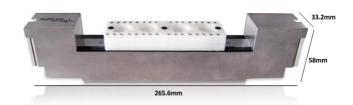[1] At 26G PRBS9, using adjacent channel as scope trigger at 3.32GHz

Mechanical Dimensions

The AT4039D is customized to fit and seamlessly function inside an Advantest HSIO test head extender. One cassette can host up to 2x AT4039Ds; you can fit a total of 4 such cassettes in a V93K tester.

Dimensions: 265.6 x 33.2 x 58 mm3

Ordering Information

Option	Description
AT4039D	200G BERT (4 CH 28 GBd NRZ/PAM4)

Please contact us at sales@multilaneinc.com.