

Innovation for the next generation

AT4039EML

4-Channel | 56 Gbaud PAM4 & NRZ | Bit Error Ratio Tester 400G | Integrated EML Laser Driver |

SSPRO, PRBS13Q & PRBS31Q | TX and RX Equalizers | Signal SNR and Histogram | High Voltage Amplitude |



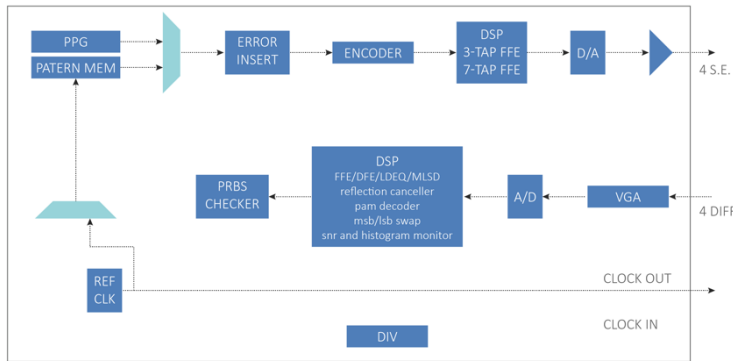
Summary

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.

AT4039EML

4x 56 GBd BERT



Introduction

The AT4039EML is a full featured 400G BERT that can be configured as a four-channel PAM4 56 GBaud or four-channel NRZ 56 Gbps lanes. Also, half rates around 28 GBd are supported.

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

It is also possible to program the TX to output a user-defined pattern of 16384 UI maximum size The transmitters are single-ended with swing up to 1800 mVpp to enable driving EML-based optics.

The error detectors are differential pairs with adaptive front-end signal conditioning.

Key Features

Transmit:

- Data Rates: 23 – 29 & 46 – 58 Gbps
- Ability to tune the bit rate in steps of 100 kbps and find the RX PLL locking margin.
- Independent control of inner eye levels
- Up to 1.8 Vpp output swing single ended supports Gray coding and polarity inversion

Available patterns are:

- PRBS 7/9/11/13/15/16/23/31/58 and their inverses
- PRBS13Q, PRBS31Q
- SSPRQ
- Square wave
- Error injection
- 3-tap LUT-based Pre- and Post-emphasis
- 7-tap linear FFE-based de-emphasis

Receive:

- Adaptive DFE and FFE with reflection canceller and MLSL.
- AGC
- SNR monitoring over time.
- PAM histogram monitor.
- PAM slicer threshold adjustable.

Error-detection on following patterns:

- PRBS 7/9/11/15/16/23/31
- PRBS13Q and PRBS31Q
- LOS indicators
- Adaptive 10-tap FFE monitor

General:

- API libraries with documentation.
- LabView driver and Python wrapper available.
- Same product available in ATE format for Verigy 93K and Teradyne.

Target Applications

Production testing of transceiver drivers and TIAs.

Functional and SI testing.

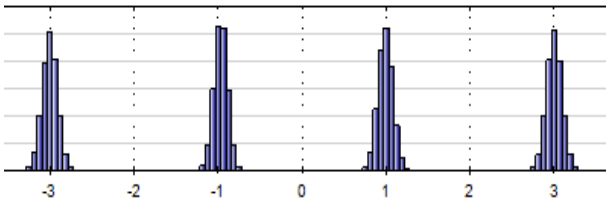


Figure 1: PAM eye histogram

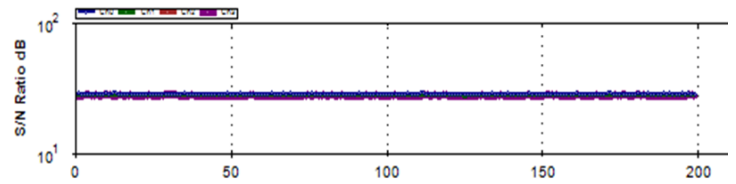


Figure 2: S/N Ratio over 200 captures

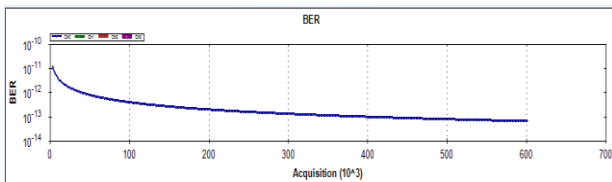


Figure 3: BER curves for one channel with 1 error inserted at the MSB and LSB respectively



Figure 4: AT4039EML Pinout. Closest to the backplane connector is TX1N

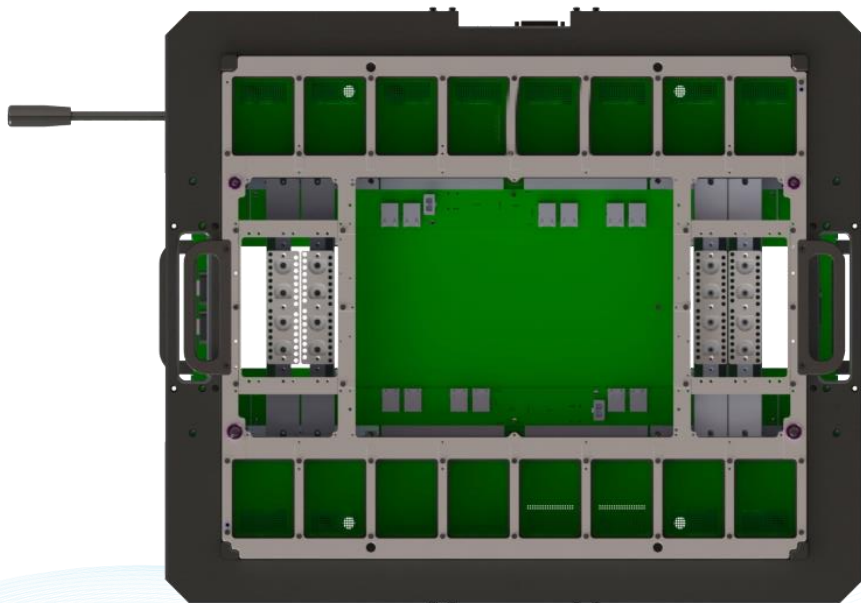


Figure 5: Four ML cassettes mounted in an Advantest V93K HSIO test head extender frame

Electrical Specifications

Parameter	Specifications
Bit Rates	23 – 29 GBaud and 46 – 58 GBaud
TX Amplitude	0 - 1800 mV
Patterns	PRBS 7/9/11/13/15/16/23/31/58 - PRBS13Q, 31Q and SSPRQ Square wave
TX Amplitude Adjustment	Steps of 1 mV
Pre- / Post-emphasis	6 dB
Pre-Emphasis Resolution	1000 steps
Equalizing Filter Spacing	1UI
Random Jitter RMS	230 fs
Rise/ Fall Time (20–80%) ¹	10 ps
Coding	DFE Pre-coding and Gray coding supported
Output Return Loss up to 10GHz	< -15dB
Output Return Loss (16-25GHz)	< -10dB
Error Detector input range	50 mV– 800 mV diff.
Total DFE/FFE/CTLE Equalization	Up to 13 dB
Error-detector VGA dynamic range	± 2 dB
TX/RX connectors	2.92 mm or 2.4 mm Connectors
Reference clock Output	Rate div 16/32/128/256
Diff. Input Return Loss	Better than 10 dB
Histogram	160 levels. Reports Counts/level based on 2 ²⁰ bits
Clock Input Range	Up to 4.4 GHz
Clock Input Amplitude	200 - 1000 mV
Input Impedance	50 Ω
Temperature range	0-75 °C
Power	110V, 1.4A or 220V, 0.9A – 50/60 Hz
Power (ATE version only)	12 V, 1.5A

¹ With appropriate pre and post emphasis settings and 50GHz scope

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	$x^{58} + x^{39} + 1$

Mechanical Dimensions

The AT4039EML is customized to fit and seamlessly function inside an Advantest HSIO test head extender. One cassette can host up to 2x AT4039EMLs; 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
AT4039EML	400G BERT

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