advICo microelectronics GmbH
Steinstr. 12
45657 Recklinghausen
Germany
info@advico.de

Eye Diagram Monitor (EDM)

IP-Core Product Brief

General Description:

In modern fiber-optic data transmission systems continuous in-service signal monitoring becomes increasingly important. The accurate measurement of eye diagrams at high data rates represents a challenging task for the measurement electronics.

advICo has developed a novel circuit technique which enables to integrate the complete circuitry for measurement of eye diagrams of ultra-fast digital signals on a single chip. The EDM is based on this patent pending circuit technique. Typical applications for the EDM are:

- In-service monitoring of signal quality in fiber-optic data transmission systems
- Adaptive dispersion compensation at data rates of 10 to 43 Gbit/s
- Compact digital measurement systems

Functions:

- Measurement of amplitude/time histogram (with synchronous reference clock)
- Measurement of amplitude histogram (with asynchronous reference clock)

Characteristics:

- Analog signal bandwidth: >30 GHz
- Amplitude resolution: ca. 15 mV differential (= 6 bit @ 1 V_{ss})
- Time resolution: ca. 1 ps (depending on reference clock jitter)
- Samples per amplitude/time window: 256, 512, or 1024 each

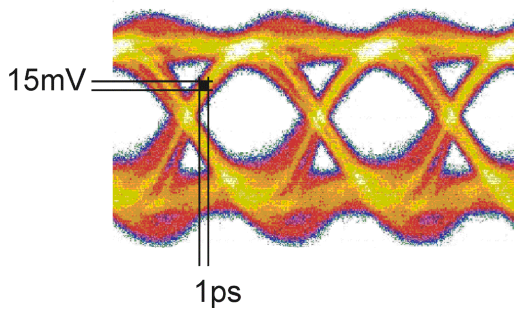

Fig.1: Amplitude/time-window resolution

- Measurement time for complete amplitude/time histogram at 43 Gbit/s: < 10ms
- Supply voltage and current: 3.3 V, 450 mA
- Semiconductor technology: 0.25 µm SiGe BiCMOS technology

Applications:

The EDM's histogram data can be readout via a digital interface. From histogram data the following information can be extracted:

- Eye-diagram representation of data signal
- Maximum and RMS Jitter
- Q-factor
- Signal levels
- Optimal decision threshold

The EDM can be used for *continuous in-service signal monitoring* in fiber-optic data transmission systems. In this case it fulfils - with reduced accuracy - the function of a digital sampling oscilloscope.

The chip is also suited for signal measurement in *fast adaptive dispersion compensator modules*. The EDM´s histogram measurement of the complete eye diagram enables the extraction of all necessary information of the distorted receive signal (even with multi-level and duobinary signals).

In comparison to other methods to measure signal quality at high data rates (Pseudo-BER measurement, BER measurement with FEC-coded data) the EDM enables the measurement of the *complete eye diagram of the distorted signal* and therefore provides more information for the dispersion compensator than other methods. Even with an asynchronous clock, e.g. when the clock and data recovery is unable to lock on the data signal, the EDM is still able to deliver accurate amplitude histogram data which enables the dispersion compensator to optimize the pulse form of severely degraded signals.

In principle the EDM can be used for optical, electronic, or combined optical/electronic dispersion compensation. The following simplified block diagrams show the EDM in combination with optical and electronic compensation.

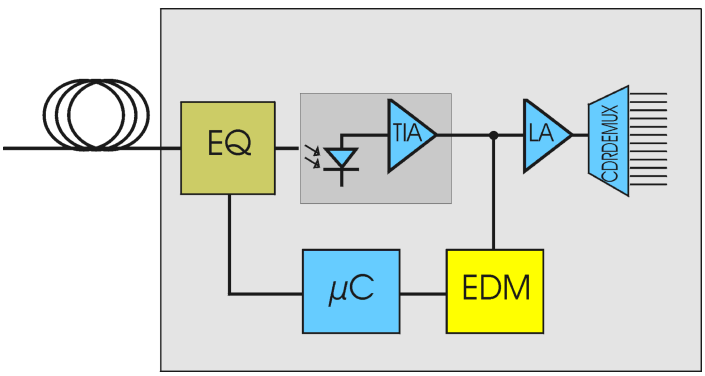

Fig. 2: Eye Diagram Monitor (EDM) with optical dispersion compensation (EQ)

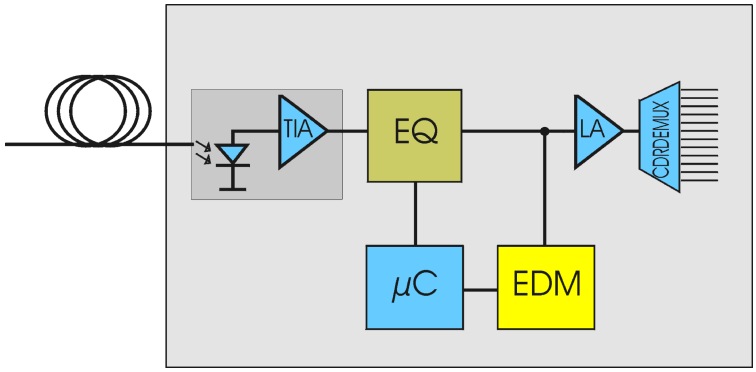

Fig. 3: Eye Diagram Monitor (EDM) with electronic dispersion compensation (EQ)

The circuit is offered as an IP-core in an advanced 0.25 µm SiGe BiCMOS technology.

For additional information please contact:

advICo microelectronics GmbH
attn. Dr. Christoph Scheytt
Steinstr. 12
45657 Recklinghausen, Germany
tel.: +49 2361 90438 71
fax.: +49 2361 90438 69
email cs@advico.de