

Application Note

Signal Integrity Performance of the Teledyne Relays GRF300/GRF303 Relay Series

The objective of this application note is to present objective data to demonstrate the performances of the GRF300/GRF303 relays in the multi-Gigabit data transmission, specifically at 10Gbps data rate. The most simple and useful tool to demonstrate the capabilities of the Teledyne Relays GRF300/GRF303 relay series is the eye diagram. The eye diagram is an oscilloscope display of a digital signal, repetitively sampled to display the behavior of the device under test (DUT). The basic information contained in the eye diagram is the amount of distortion (set by signal-to-noise ratio), time variation of zero crossing, and the signal-to-noise at the sampling point.

Measurements

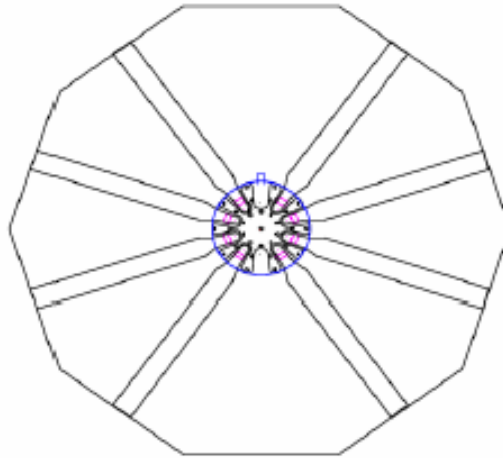
Measurements were made using the Agilent AG86100 Digital Communication Analyzer with 12Ghz-pattern generator and 10Ghz-clock source. The relay was mounted on an evaluation board with the following descriptions. Two (2) RF 3-ft long cables were used for measurements.

Pattern Generator Settings

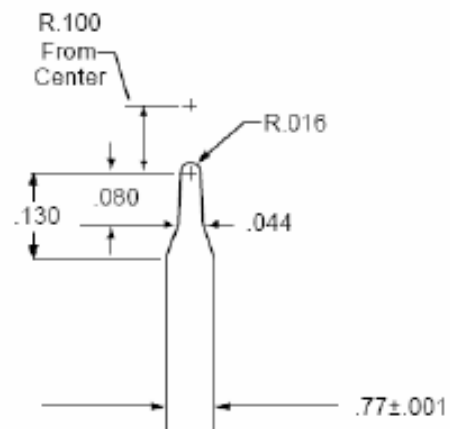
- $2^{31}-1$ PRBS signal
- 10Gbps data rate
- Data amplitude of 500mVpp

Oscilloscope Settings

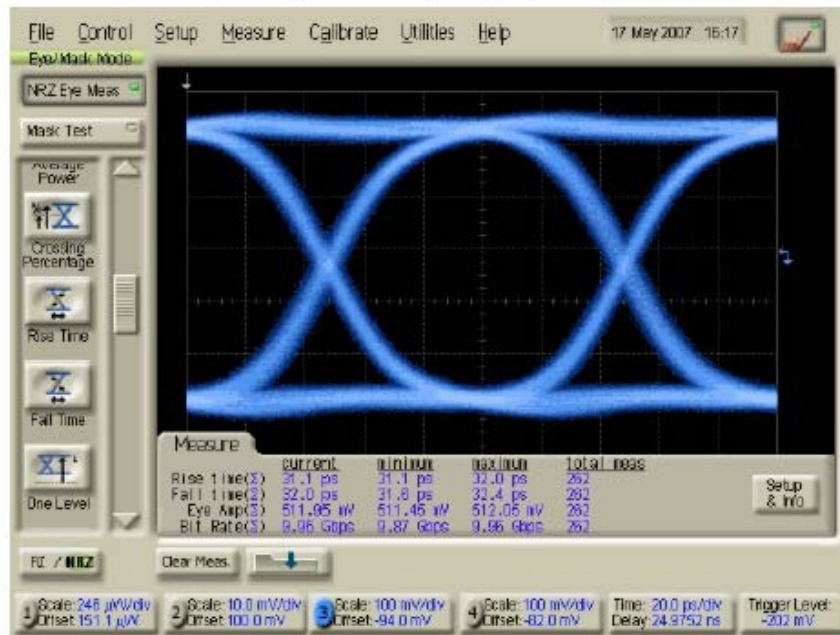
- Measurement threshold set to 20%-80%
- NRZ Eye/Mask mode measurements: rise time, fall time, eye ramp and bit rate



- Material: RT/duroid 6002 [Rogers].
- Thickness: 0.030"
- Copper foil thickness: 0.00134"
- Trace layout:

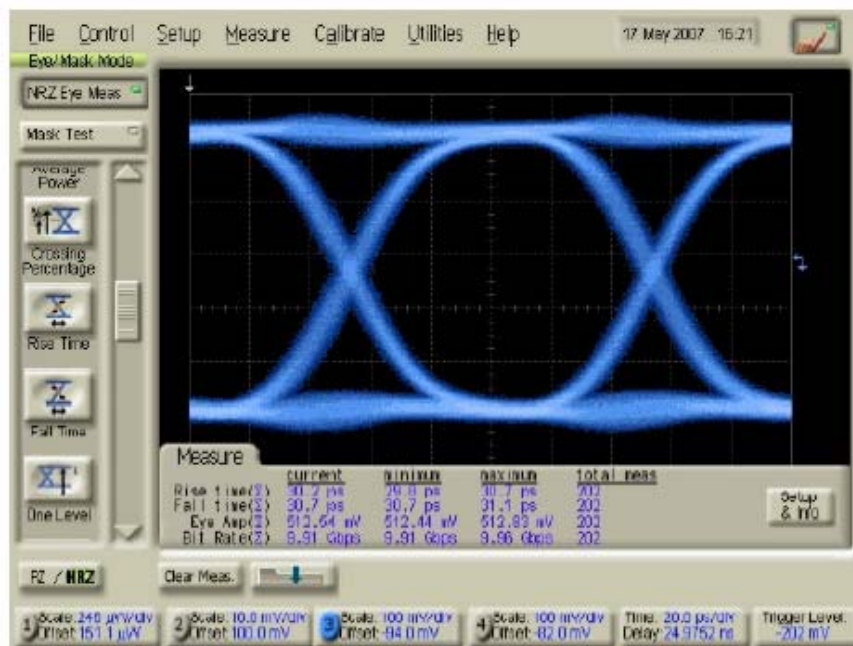


Eye Diagram of relay at normally closed position (coil off)



- i. $R_{\text{TOFF}} = 31.1 \text{ pS}$.
- ii. $F_{\text{TOFF}} = 32 \text{ pS}$.
- iii. $V_{\text{OFF}} = 511.95 \text{ mVpp}$.

Eye Diagram of relay at normally open position (coil on)



- i. $R_{\text{TON}} = 30.2 \text{ pS}$.
- ii. $F_{\text{TON}} = 30.7 \text{ pS}$.
- iii. $V_{\text{ON}} = 512.54 \text{ mV}$

Conclusion

The eye diagrams provided herein conclusively demonstrate that the Teledyne Relays GRF300/GRF303 relay series would perform very well with 10Gbps signal. The most valuable characteristics of the GRF300/GRF303 relay series when mounted on impedance matched transmission lines is the monotonic insertion loss (S21) of its signal path to the maximum useful bandwidth, up to 19Ghz on normally open contacts and up to 21Ghz on normally closed contacts. By comparison, Teledyne Relays have observed drastic roll-off in insertion loss in other non-impedance-controlled relays.

