



## Semtech Turns to Tektronix DSA8300 Sampling Scope to Characterize New 25-28 Gb/s CDR Devices

### Customer Solution Summary

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#### Challenge

Semtech needed to characterize and validate the performance of a new Clock and Data Recovery (CDR) device used for 25-28 Gb/s signal conditioning. Semtech CDRs have always provided industry leading performance and this device was no exception. The superior performance of the CDR resulted in extremely low output jitter in the sub 100fs rms range and traditional test equipment in the market was not able to accurately measure such low levels of jitter.

#### Solution

The industry-leading low noise, low jitter capability of a Tektronix DSA8300 Series Sampling Oscilloscope combined with an 80E09B sampling module provided better signal integrity and greater margin visibility on the CDR devices.

#### Benefits

With the test set-up in place, thousands of reliable jitter measurements were performed to characterize the true device performance and determine margins under a variety of conditions and worst-case scenarios. This validation is a critical part of the Semtech quality process and ensures that every device's performance lines up with or exceeds design expectations, giving Semtech customers the confidence that the devices will perform as specified in all application scenarios.



Semtech designs innovative optical, analog and mixed signal semiconductor solutions to serve the rising global demand for high-speed data transmission products. Semtech's offerings are designed to improve performance and reliability, simplify design, lower system costs and decrease time to market.

Among Semtech's product offerings are the GN2425 and GN2104 Clock and Data Recovery (CDR) chips designed to handle 25 Gb/s data streams within next generation 100 Gb/s pluggable fiber optic modules, line cards and direct-attach copper cables. The latest offering, the GN2104 is a uni-directional quad-CDR design. These products extend the reach and robustness of 4x25 Gb/s serial links by compensating for losses in the transmission medium and by resetting the jitter budget.

A key challenge was how to accurately test these devices given data rates at the bleeding edge of test instrumentation performance. Semtech CDR's exceptional output jitter performance, with expected random jitter numbers in the sub 100 fs range, mandated use of the best and most precise signal acquisition system available from Tektronix to characterize this highly accurate level of industry-leading chip performance.

Accurate validation and characterization of the CDRs is of critical importance for Semtech and its customers. At Semtech, "good enough" is not good enough, excellence is required. Of all the specifications that customers look at when considering a retiming device for high-speed optical controllers, one of the most important is the random jitter of the CDR. As a retiming device, the intent is for it to remove data dependent jitter or to compensate for a lossy link without adding much noise of its own.

"Semtech CDRs have always provided industry leading jitter performance. As rates increase, it becomes more and more critical to accurately measure device jitter components hence the need for test equipment with a very low noise floor," said Raza Khan, product manager for Semtech.

To accurately test such low jitter values in the Semtech CDRs, the Tektronix DSA8300 Series Sampling Oscilloscope combined with an 80E09B sampling module, the only offering available that could provide the precise measurement accuracy needed, was used.

The DSA8300 Series' modular platform supports a range of electrical and optical sampling modules, providing a complete high-speed PHY layer measurement system for characterization of high-bit rate devices such as the Semtech's GN2425 and GN2104. The DSA8300 Series features <100 fs intrinsic jitter and 70 GHz bandwidth to allow full characterization of high bit-rate signals.

### Remote Sampling Heads Make the Difference

The 80E09B is a dual channel acquisition module with remote heads, user selectable bandwidth (30, 40, 60 GHz) and excellent noise performance (< 300uV @ 30 GHz). Combining all these characteristics results in a measurement system well suited for the high speed, low amplitude signal fidelity challenges seen when speeds reach 28+ Gb/s.

Each small form factor remote sampler is attached to a 2-meter cable to eliminate losses associated with lengthy cables and probes. This allows for placement of the sampler in close proximity to the device under test using a fixture, thus minimizing loss and often eliminating the need for de-embedding.

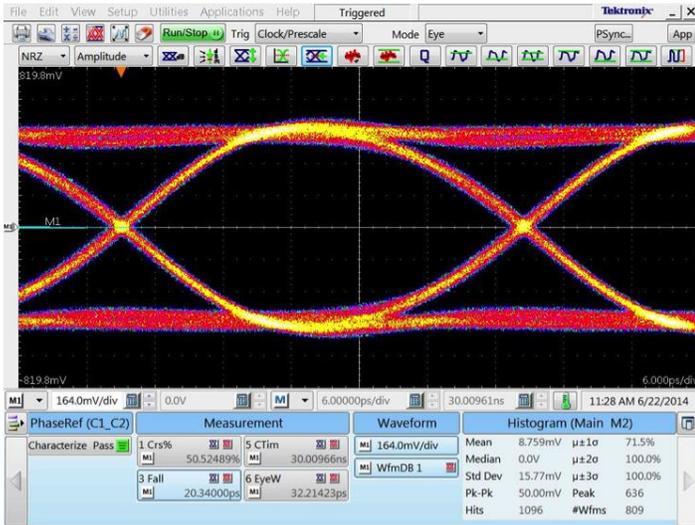
*“By placing the remote heads directly on the board, it was possible to avoid ISI jitter accumulation due to long cables.”*

Raza Khan  
Product Manager, Semtech

For Semtech's application, the remote samplers proved to be an important factor. “By placing the remote heads directly on the board, it was possible to avoid ISI jitter accumulation due to long cables,” Khan explains. “Utilizing this test equipment, Semtech was able to measure accurately, the true jitter performance of the CDRs”



The remote heads and the 70 GHz oscilloscope bandwidth also provided the performance needed to handle the fast rise times on signals coming out of the device. This allowed for more accurate vertical noise measurements and cleaner eye diagrams such as seen in the screen shot below.



With the test solution in place, the typical Tj (total jitter) measured in at around 5 ps while the all important Rj (random jitter) figure was sub 100 fs, reaching close to the equipment noise floor. In all, thousands of jitter measurements were performed involving different parts and changes in voltage, temperature and other variables to ensure that the parts were tested in all application scenarios.

“The level of the testing accuracy that was achieved with the DSA8300 allowed Semtech to demonstrate the exceptionally low levels of jitter in our newest generations of CDRs” said Alex Lait, senior manager of validation for Semtech. “This validation is a critical part of the Semtech quality process and ensures that the device performance lines up with or exceeds design expectations, giving Semtech customers the confidence that the devices will perform as specified in all application scenarios.”