

SnpExpert: S-Parameter Exploration

S-parameters, traditionally used in RF/Microwave design, are widely adopted by high speed digital designs as the multi-gigabit interface continues to advance to higher data rate. Xpeedic SnpExpert provides a quick way to understand the electrical characteristics of the passive interconnectors in a system by not only viewing the S-parameter in frequency domain but also examining the time domain reflectometry (TDR). One-click definition of differential pairs and victim/aggressor setup, together with the built-in NEXT, FEXT, PSXT, ILD, ICR, and ICN, allows user to quickly evaluate the crosstalk. The built-in delay and skew calculator requires no cumbersome circuit schematic setup. The built-in compliance metrics with IEEE 802.3ap, 802.3ba, 802.3bj, SAS, PCIe, SATA and OIF CEI 25G/28G standards quickly reveal the S-parameter compliance. The built-in passivity, causality, reciprocity, and stability metrics tell the quality of the S-parameter, and built-in enforcement algorithm fix S-parameter quality issues. The built-in template automates the process from S-parameter plotting to report in Word or PPT. The through-only de-embedding method helps SI engineers to quickly obtain the DUT characteristics by removing the fixture effect. Accurate NRZ and PAM-4 eye diagram calculation with equalization and pre-emphasis technology help user get an intuition feeling about high speed channel performance.



Key Points

- Implementation of Ribbon UI offered by Microsoft in their office solutions, and makes Xpeedic application keeping up with the time, and has a modern look and feel.
- Fast multiple S-parameter touchstone files import with multi-threading technology enabled to accelerate reading speed.
- Support plotting frequency domain Sparameter, time domain reflectometry (TDR), Smith Chart and Polar Plot.
- Grid plot (PLTS) for S-parameter and TDR.
- One-click to define differential pairs and victim/aggressor pairs
- Built-in crosstalk analysis for both single-ended and differential pairs, and plot FEXT, NEXT, PSXT, ILD, ICN, ICR, IL_fitted, ILD_rms and ICR_fit based on compliance metrics.
- Built-in compliance metrics such as IEEE 802.3ba, IEEE 802.3bz, IEEE 802.3bj, OIF CEI-25G/28G, SAS 3.0, PCIe 3.0, SATA 3.2,MIPI, SATA3.0 and so on.
- Built-in passivity, causality, reciprocity, stability metrics calculation and enforcement algorithm to reveal and correct Sparameter quality.
- Built-in delay and skew calculator for both single-ended and differential pairs.
- Built-in several S-parameter utilities, such as reorder, gating, split, combining, multiple S-parameter cascading, averaging and export.

- Built-in template to automate the process from S-parameter plotting to report in Word and PPT
- Built-in template for RF/Microwave components such as inductor, capacitor, filter, balun, diplexer and coupler
- Three de-embedding methods to obtain the DUT characteristics, including Open-Short De-embedding, Open-Thru De-embedding, Thru-Only De-embedding and Halve S-parameter Matrix.
- Support several Dk/Df extraction methods, including S3 based method, Delta-L based method and optimization based method.
- Support NRZ and PAM-4 eye diagram, also add CTLE, FFE and FIR for Tx or Rx during eye diagram calculation, CTLE compensation can be previewed.
- Support double and complex reference impedance conversion.
- Support variable definition with builtin math functions, including unwrap, moving_average and so on.
- Add S-parameter and TDR quick plot panel in SnpExpert main window.
- Support Python Scripts



FEATURES

Modern Look and Feel

Implement the concept of Microsoft Ribbon, and makes SnpExpert keeping up with the times.



SnpExpert

Easy Diff-Pair Setup and Processing

SnpExpert provides easy ways to setup the differential pairs and rich functions for post-processing.



Diff-Pair Setup

Easy S-parameter and TDR Plot

Provides several ways to easy plot frequency domain S-parameter and TDR.



S-parameter and TDR

Grid Plot

SnpExpert allows users to grid plot diffpair S-parameter and TDR in both singleended and differential modes similar to PLTS.



Grid Plot



Powerful Crosstalk Analysis

Crosstalk analysis flow is quite helpful for user to evaluate the crosstalk effect after setup victim and aggressor:

- Crosstalk between single-ended port
- Crosstalk between differential pairs
- Crosstalk between single-ended port and differential pair

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Victim/Aggressor Setup

SnpExpert has built-in crosstalk plots including FEXT, NEXT, PSXT, ILD, ICN, ICR, IL_fitted, ILD_rms and ICR_fit.



Crosstalk Plot

Compliance Metrics

Built-in Compliance metrics: IEEE 802.3ap, IEEE 802.3ba and, IEEE 802.3bj, OIF CEI-25G/28G, SAS 3.0, PCIe 3.0, SATA 3.2 and so on.



Built-in Compliance Metrics

Quality Metrics

SnpExpert has built-in algorithm to evaluate S-parameter quality metrics and fix quality issues based on enforcement algorithm, including passivity, causality, reciprocity and stability.



Quality Metrics



Delay and Skew Calculator

SnpExpert has built-in delay and skew calculator for both single-ended trace and differential pairs.

Input							
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S-Parameter:	1 Xpeedic.s02p(E:/Test)						
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	3 E1_T1:E1_T2	118.662	10.0753	24.0356	23		
	4 F1_T1:F1_T2	128.737		34.1109	8		
	5 A2_T1:A2_T2	87.071	3.51302	-7.55528	83		
	6 B2_T1:B2_T2	90.584		-4.04226	E		
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Delay and Skew Calculator

Built-in template for RFIC

SnpExpert has built-in template to show Sparameter, L, Q, M, K and other parameters for various RF components, such as inductor, transformer, filters, balun, diplexer, and coupler.



RFIC Template

Powerful De-embedding Method

Support multiple de-embedding methods to meet different application scenario:

- Open-Short De-embedding to remove the pad parasitic for on-chip applications.
- Through-Only De -embedding to remove the fixture effect for SI applications, support both symmetric and asymmetric TOD w/ and w/o fixture A or fixture B.
- Halve S-parameter Matrix to get the s parameter of the 2x through-only fixture.



De-embedding Method

Accurate Dk/Df Extraction

After using Thru-Only De-embedding or Delta-L De-embedding method to remove fixture effect from DUT, Dk/Df extraction method is applicable to extract Dk, Df and even surface roughness. SnpExpert supports several Dk/Df extraction methods, including S3 based method, Delta-L based method and optimization based method. Extracted Dk/Df is quite easy to export for specified frequency points in excel format.



Data Source	Dk/Df Extraction	ng Method			
*	S3 Based	Oelta-L	Based	 Optimization Ba 	
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	Transmission	Line			
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CTLE, FFE, DFE settings

Dk/Df extraction

Eye Diagram

Plot NRZ and PAM-4 modulation eye diagram based on bit pattern, data rate and rise/fall time setting, also support CTLE, FIR, FFE and DFE for both Tx and Rx.



Eye Diagram

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