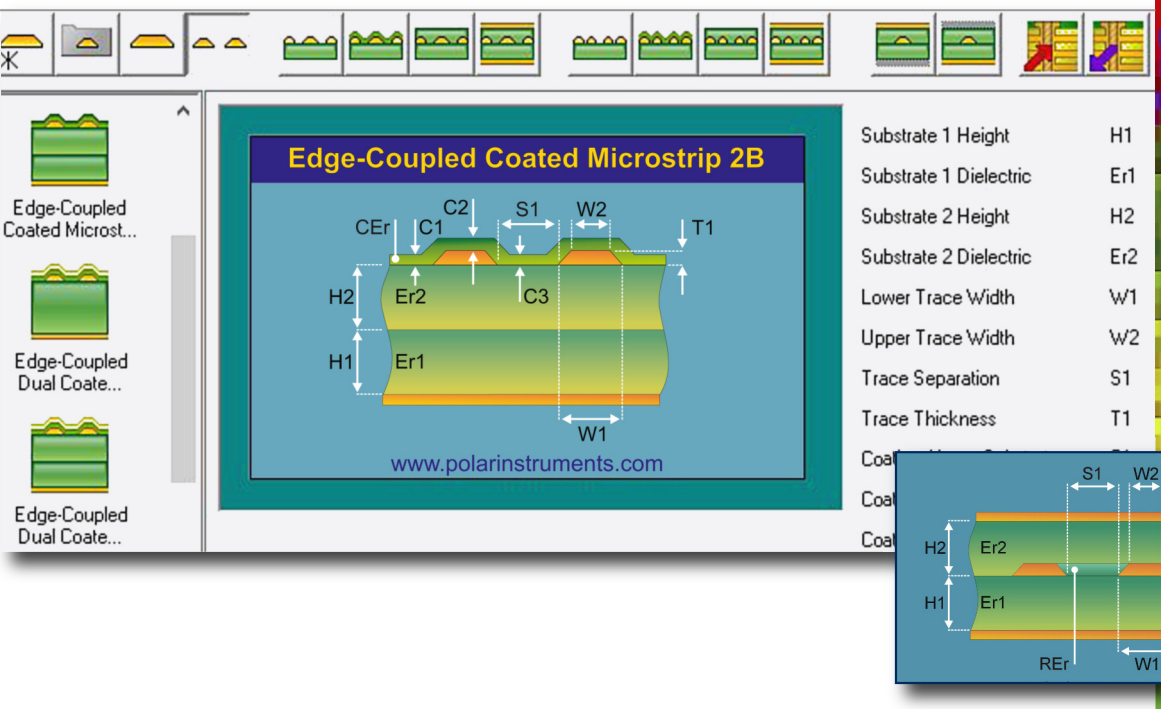
Controlled impedance field solver for multiple dielectric PCBs



Boundary element method field solver includes modeling for multiple changing parameters and local resin rich areas

Si8000m

- Accurate BEM impedance field solver
- Use with single and multiple dielectrics
- Predict manufacturing tolerance
- Sensitivity Analysis increases yields
- Model differential, common, odd mode and even mode impedance
- Goal seek on single or multiple parameters

Polar

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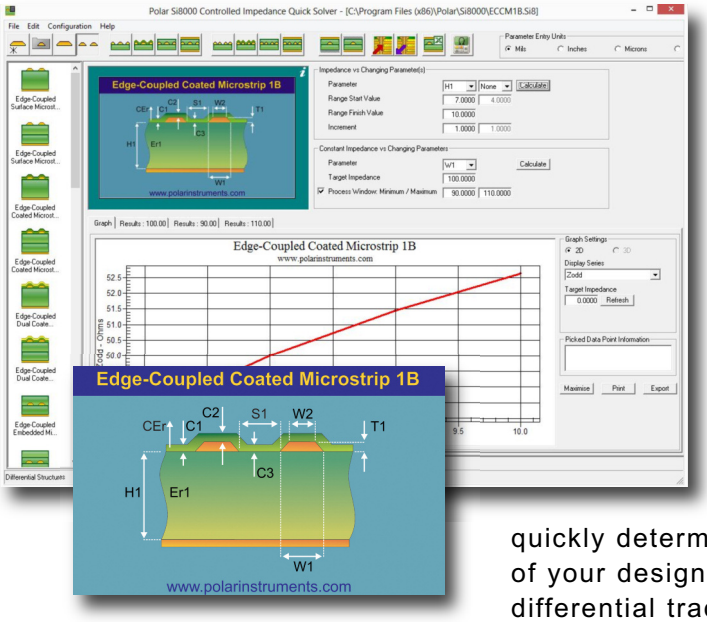


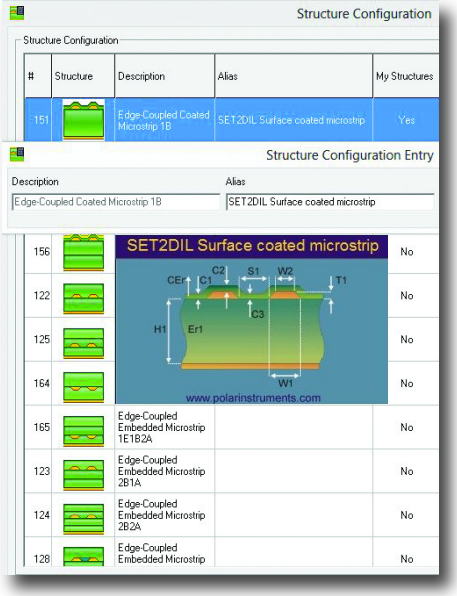
Simplifies transmission line modeling

Over 100 transmission line structures

Boundary element method (BEM) field solver

Analyses single and multiple dielectric builds

Includes solder-mask effects



Apply your in-house names with My Structures

Why use Polar's Si8000m PCB controlled impedance field solver?

Powerful impedance modeling

The Si8000m has long been the industry-standard system for fast and accurate controlled-impedance calculations and for modeling PCBs with lossless controlled impedance transmission lines. Now the Si8000m gives you even more power to model impedance by combining Polar's proven boundary element field-solving engine with easy graphing of process windows. With this combination of powerful impedance modeling you can quickly determine the manufacturing variations for each of your designs and model resin-rich areas between differential traces to achieve the highest yields from your production process.

Model multi-variable changes

Use the Si8000m's Sensitivity Analysis to goal-seek and extract accurate impedance calculations for multiple parameter variations without the need to create Excel workbooks. Explore 'what if' and worst-case scenarios by entering minimum and maximum process parameters, absolute or percentage tolerances, and step line widths in standard increments. With each change, Si8000m automatically recalculates impedance in your design. The Sensitivity Analysis view lets you graph these results in more detail to fine-tune your design for higher yields. For more complex modeling power, users also have the option to run scenarios using the field-solver via a licensed link between the Si8000m Quick Solver and Microsoft Excel.

What does Si8000m bring you?

Optional integration with Speedstack stackup design system

Increase your control over the PCB fabrication process by using Si8000m seamlessly interfaced to the Speedstack layer stackup design and documentation system. Speedstack PCB is a bundled package of Si8000m and Speedstack which allows you to keep all of your stackup design data and associated transmission line materials and geometries in one convenient file, complete with clear and professional printed stackup documentation. You have the choice of generating stackups using generic or virtual materials, or specifying the base material by its manufacturer part number.

Accurately predict process yields – before you build – by exploring nominal and worst-case scenarios with the Si8000m Quick Solver.

Links to Speedstack Stackup Design System – accepts entry of data supplied by your board fabricator

Differential impedance PCB structures

Differential coplanar impedance structures

Single-ended impedance modeling

Microstrip and stripline constructions

Field-solving by Boundary Element Method (BEM)

Extraction of odd-mode, even-mode, common and differential impedance

Who should use Si8000m?

Engineers and designers save time with the Si8000m

With ever-increasing speeds, the latest circuitry demands high-quality, controlled-impedance printed circuit boards. Today's PCB is not just a simple electrical interconnection device, it is a critical and highly-specified component in its own right. Your challenge, therefore, is to ensure that transmission line characteristics meet the demands of the system components.

If you are a designer or engineer the Si8000m will save you significant time compared with traditional modeling methods, by allowing you to graphically choose the structure you need to model as well as the associated geometric and material data.

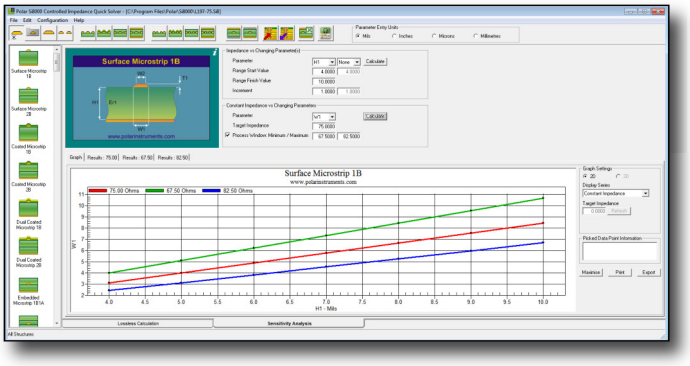
Testing for controlled impedance

Impedance needs to be controlled at every stage of your PCB process. So whilst the Si8000m gives you tight control in the pre-build stages, Polar's Controlled-Impedance Test System (CITS) extends that control into the fabrication process.

Polar is unique in providing you with complementary tools for both the design and production stages of your PCB fabrication process. Polar systems are used by leading PCB manufacturers and OEM designers around the world, giving you the confidence that these systems are proven and robust.

Sensitivity analysis

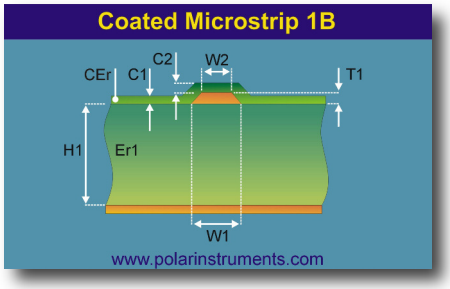
Sensitivity analysis gives you fast and interactive built-in graphing of impedance variation against a range of physical structure parameters. Graph impedance against any varying structure parameters.

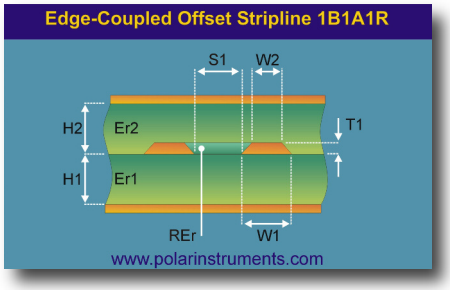


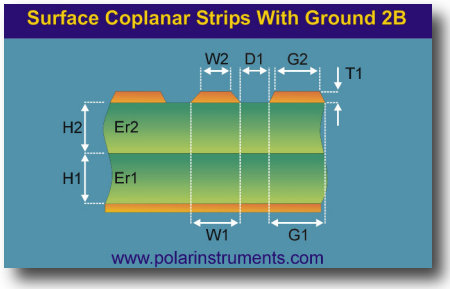
- Set a target impedance line on the graphs
- Export the graph in JPG format or the test results to the Windows clipboard for use in Excel
- Graph impedance for single-ended structures
- Graph differential structures

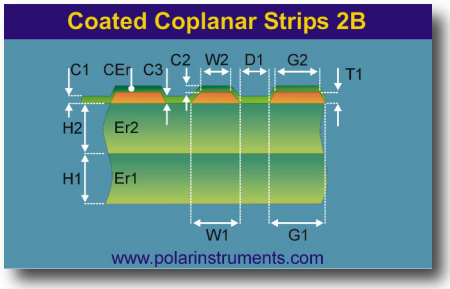
Process-window

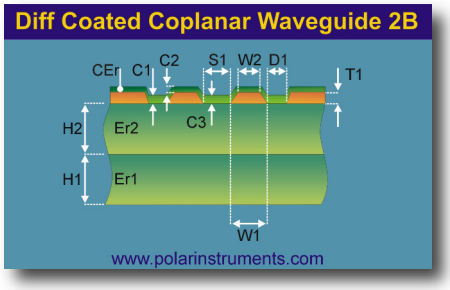
The addition of process-window calculations allows you to check the degree of process-window for a given impedance. You can use these calculations to adjust designs prior to layout to ensure that you give your design the maximum possible window to keep yields up and costs down.

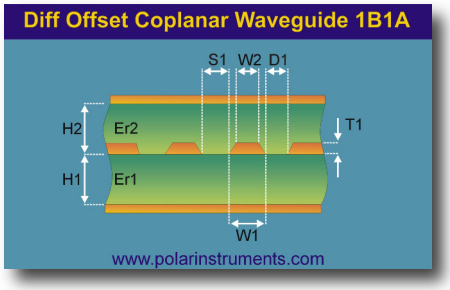












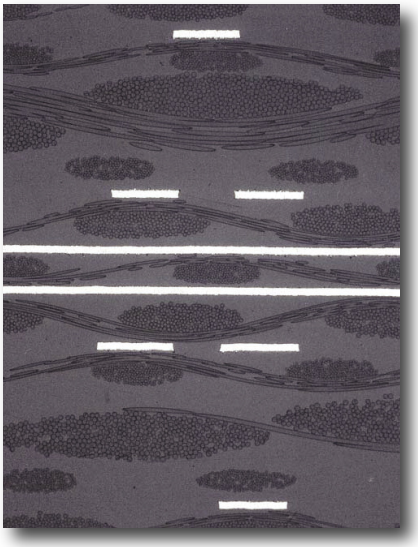
Comprehensive range of controlled impedance structures

The Si8000m comes with over 100 of the most used controlled impedance structures, offering the flexibility to meet your most common layout challenges. You can analyse single or multiple dielectric builds and evaluate solder-mask effects with flexible options for setting mask coverage as adjacent, between or above traces.

Surface coating can be overlooked when modeling and the Si8000m models the resist thickness adjacent to, above and between surface traces. This offers a much more elegant solution which can be tailored to the particular resist application method in use on your boards. The new Si8000m also extracts even and common mode impedance. (Even mode impedance is defined as the characteristic impedance of one side of a transmission line pair when both lines are driven by a signal of equal magnitude and polarity.) It is becoming increasingly necessary to control these characteristics on high speed systems such as USB2.0 and LVDS.

The Si8000m field solving impedance design system brings you advanced field solving methods to model most circuit designs and is totally complementary to the CITS880 Controlled Impedance Test System. CITS measurement systems have been in use with leading PCB manufacturers throughout the world since 1991 and Polar is recognised as a world leader in production line impedance testing.

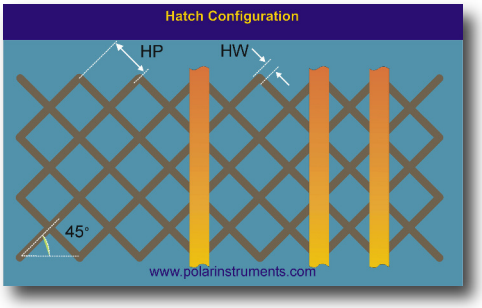
Defining local dielectric constant



To maximise first-time yields, the Si8000m impedance field solver helps you to define the local E_r between the traces in any woven glass reinforced composite such as the polished microsection of FR4 shown in the photograph. The glass has a dielectric constant of 6, but it is often filled with resin which has a dielectric constant of 3, or even lower if it is a high-frequency base material. On fine-geometry boards, where the differential pair or coplanar waveguide is designed with very close spacings, almost all of the electric field occurs in the horizontal gap between the traces. Defining local variations in E_r, therefore, is crucial for the highest accuracy in predicting impedance.

Additional Si8000m tools

These optional additions to the Si8000m extend your control over impedance in your design.

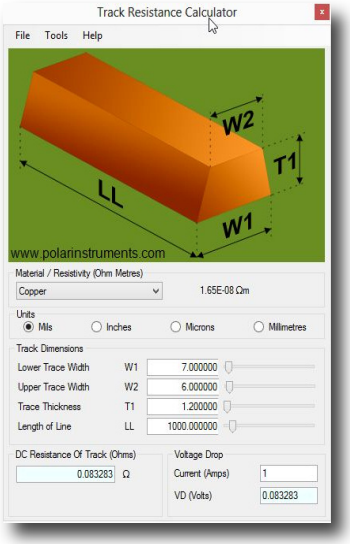


Crosshatch ground modeling

For flex and flex-rigid PCBs, Si8000m gives you an optional Crosshatch Flex Enhancement (XFE) tool. The XFE lets you set the overall copper percentage on a cross-hatched ground-plane and calculate the effects of ground-plane cross-hatching on overall transmission-line impedance.

Track resistance calculator

An optional track resistance calculator takes the geometric trace data from the Si8000m to perform rapid and easy calculations on both track resistance and voltage drop for a given track length. Specify track dimensions in mils, inches, microns and millimetres and perform calculations for the most popular board trace materials, including copper, aluminium, gold, nickel and silver; or add your own materials with defined resistivity values.

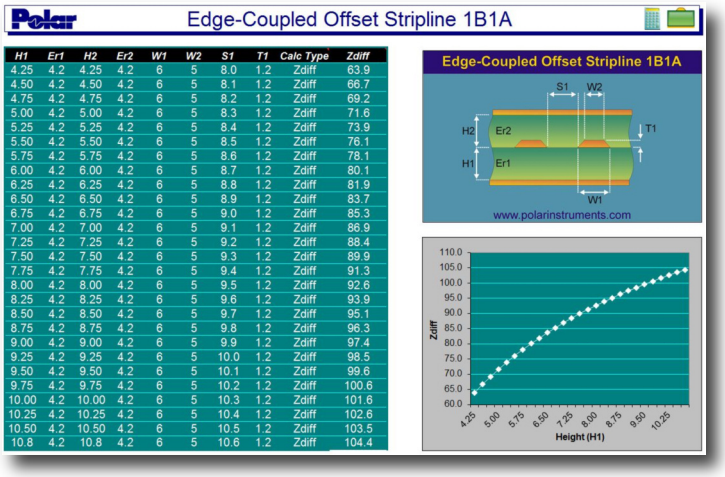


Licensing options

Choose from a wide range of license options, with packages which give you the best value for your investment. License models include quarterly and annual subscriptions, 12 and 24 monthly contracts, electronic and portable USB key options, along with node limited or enterprise wide activation. Ask your local Polar office for information, or check online at polarinstruments.com. The Si8000m is licensed with FlexNet Publisher.

Si Excel Interface

An optional package of Microsoft Excel workbooks links directly to the Si8000m impedance field solver, or to the Si9000e transmission-line field solver. This gives you access to lossless and impedance field solving, combined with powerful and flexible tools for calculating and graphing the impact of changes in a range of parameter values.



By extending the Sensitivity Analysis featured in the Si8000m or Si9000e, the Si Excel interface allows you to graph any parameter using the pre-prepared Microsoft Excel workbooks or to build your own workbooks to model your process.

Need to calculate insertion loss?

Si8000m is designed for lossless transmission lines – typically up to 2GHz. If you need to predict insertion loss for ultra high speed differential signals please refer to the Si9000e.

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Si8000m Controlled Impedance Field Solver

Si8000m models the characteristic impedance of lossless PCB transmission lines and is typically suitable for lines operating up to 2–3GHz. For ultra high speed lines where broadband modeling and insertion loss are required refer to the Si9000e.

Models over 100 structures, including:

Single ended structures:
- Surface microstrip
- Coated microstrip
- Embedded microstrip
- Offset stripline

Differential structures:
- Edge-coupled surface microstrip
- Edge-coupled coated microstrip
- Edge-coupled embedded microstrip
- Edge-coupled offset stripline

Coplanar:
- Surface coplanar
- Coated coplanar
- Embedded coplanar
- Offset coplanar

- Differential surface coplanar
- Differential coated coplanar
- Differential embedded coplanar
- Differential offset coplanar

Parameter entry units:
Mils, Inches, Microns, Millimeters

Sensitivity analysis
Impedance v changing parameters
Constant impedance v changing parameters
Process capability

Optional modules:
Si Excel Interface – grants direct access to the Si8000m calculation engine via Microsoft Excel
Track Resistance Calculator – uses Si8000m's geometric trace data to calculate track resistance and voltage drop for a given track length
Hatch Plane Mode (XFE) – for non-ideal ground return in flex and flex-rigid structures

System requirements:
System requirements are outlined in Application Note AP605

Polarcare maintenance and support

Polarcare provides technical support as well as updates and license protection. Polarcare subscribers may submit feedback to the Polarcare development panel to influence future maintenance releases. In addition, Polarcare provides protection for your software and license against total loss from any cause. The Polarcare brochure and the Polar website include details of the full range of Polarcare benefits.

About Polar Instruments

Polar Instruments is a market leader in designing and manufacturing tools to simplify and enhance the design, fabrication and testing of printed circuit boards (PCBs). Their innovative tools include the industry-standard Controlled Impedance Test System (CITS) which provides the global PCB industry with an easy-to-use test system for high-speed digital and RF boards, as well as class-leading tools for fast and accurate design and testing of controlled impedance in PCBs. Polar also leads the industry in tools for PCB layer stackup design and documentation. Polar Instruments was established in 1976 and now has operations and channel partners in the US, UK, Europe and Asia Pacific.

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