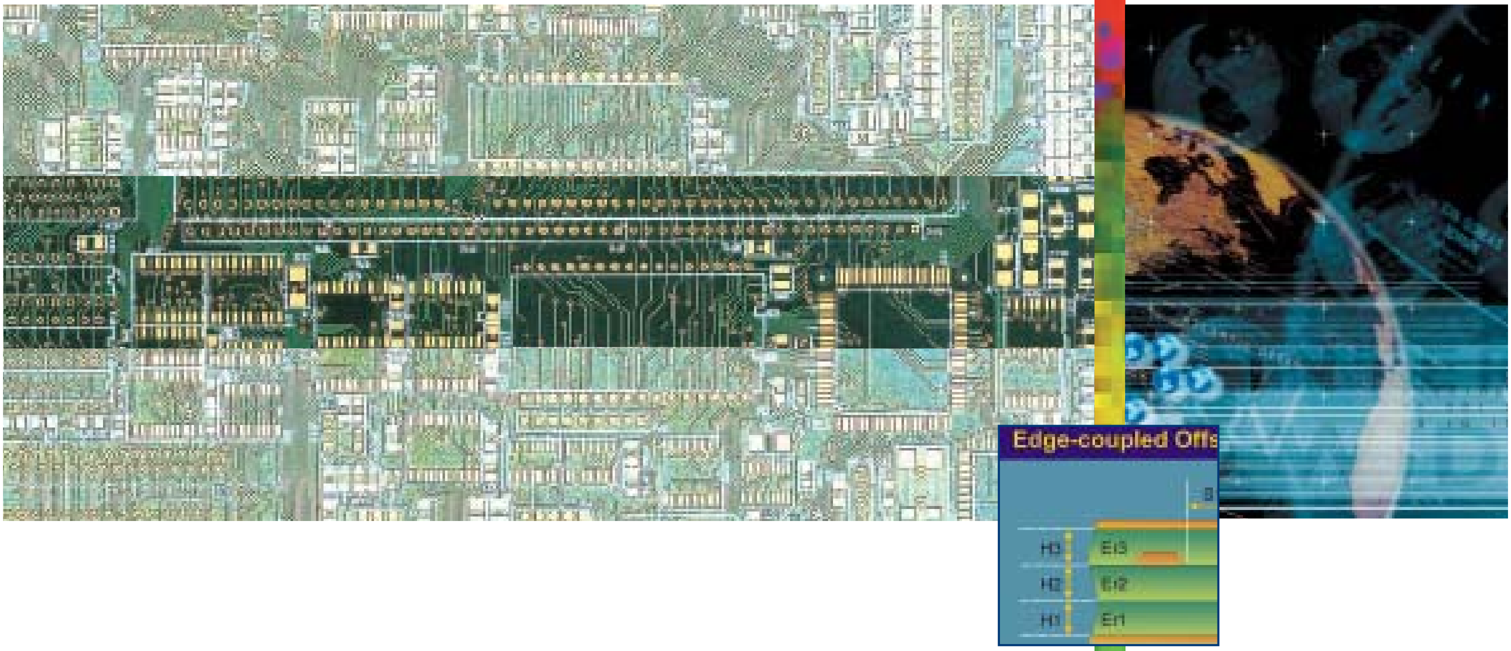
Controlled Impedance Design System for Multiple Dielectric PCBs



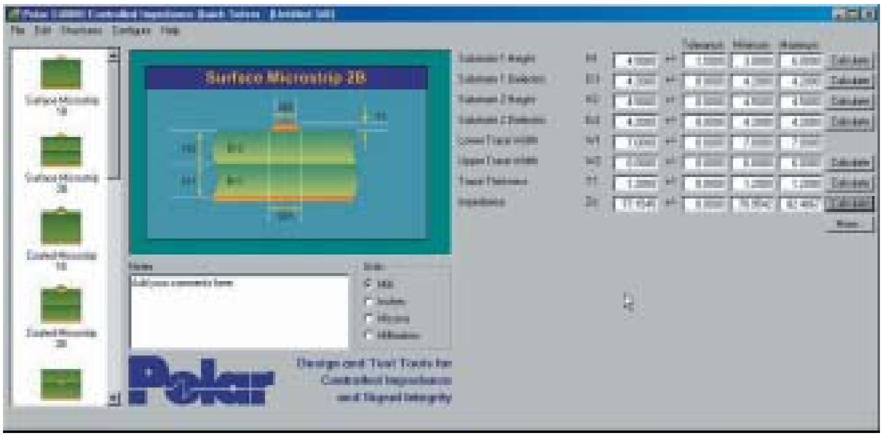
Boundary Element Method Field Solver models multiple dielectric pcbs and local resin rich areas

Si8000m

- *Impedance goal seeking shortens design cycle*
- *Sensitivity Analysis increases yields*
- *For PCB design and front end*
- *Goal Seek calculates dimensions*
- *One Click - setup*
- *Fast - accurate*
- *Model odd, even, differential and common mode*
- *Predict tolerance*

Polar

polarinstruments.com



The new Si8000m Quicksolver lets you solve for both nominal and worst case scenarios giving you an indication of process yield before you start your build process

Enhanced Quicksolver speeds design

Powerful impedance design system

New boundary element (BEM) Field solver engine

Sensitivity Analysis increases yields

Ideal for PCB design and front end

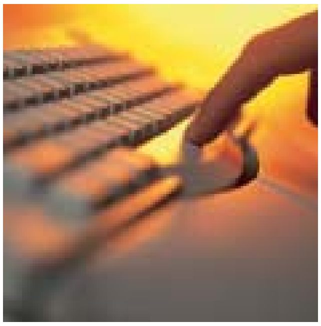
Easy graphing and sharing of data

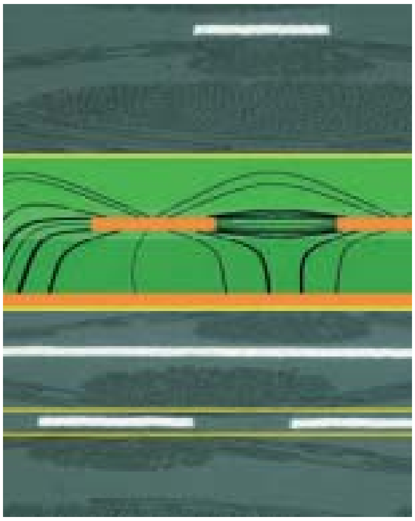
Predict impedance tolerance

Designed especially for extracting controlled impedance parameters on multiple dielectric builds, the new Si8000m employs an all-new boundary element field-solving engine. Whilst retaining the ease of use and user interface of the popular Polar Si6000, the Si8000m is a brand new design able to model a wide range of single and multiple dielectric stackups, whilst retaining flexibility to add new structures as they arise.

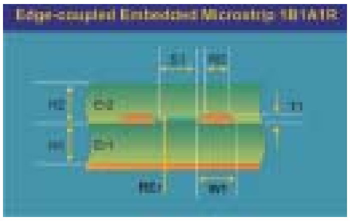
In demanding applications and high volume environments where you need to extract the highest yields from your production process the Si8000 can even model resin rich areas between differential traces.

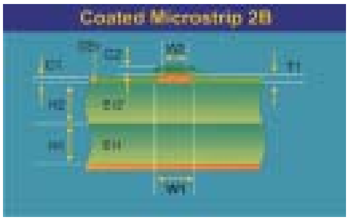
The Si8000m employs an enhanced version of the Quicksolver interface seen in the Polar Si6000. Si8000m Quicksolver supports goalseeking, and impedance extraction at the click of a mouse. And, new to the Si8000m Quicksolver is the ability to enter minimum and maximum process parameters. This lets you calculate “what if” and worst case scenarios, without the need to use Excel spreadsheets. Excel remains a key feature in the Si8000m, allowing you to build customised spreadsheets based on direct access to the boundary element field solving engine.

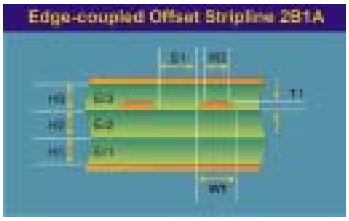


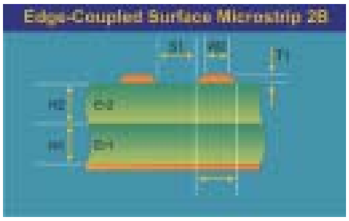


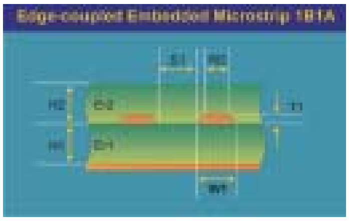
Account for local variations in dielectric constant

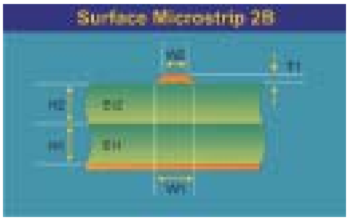


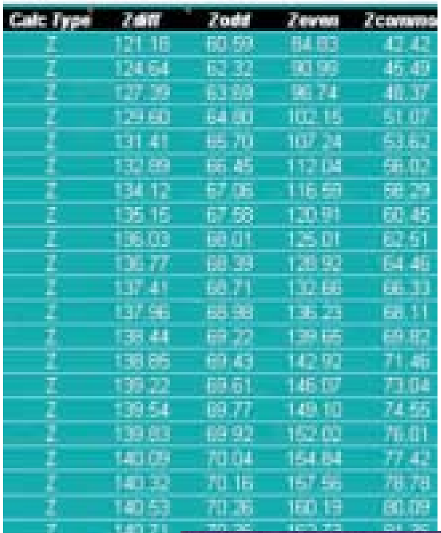




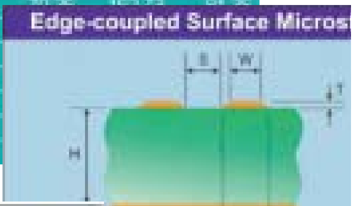






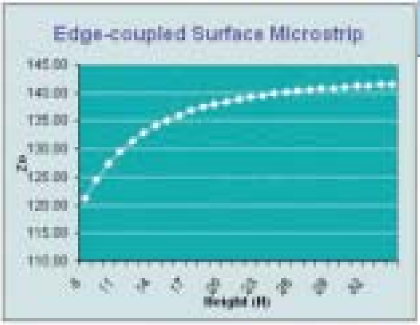


Calc Type	Zdiff	Zodd	Zeven	Zcomm
Z	121.16	60.59	84.83	42.42
Z	124.64	62.32	90.99	45.49
Z	127.39	63.69	96.74	48.37
Z	129.60	64.80	102.15	51.07
Z	131.41	65.70	107.24	53.62
Z	132.89	66.45	112.04	56.02
Z	134.12	67.06	116.59	58.29
Z	135.15	67.58	120.91	60.45
Z	136.03	68.01	125.01	62.51
Z	136.77	68.39	128.92	64.46
Z	137.41	68.71	132.66	66.33
Z	137.96	68.98	136.23	68.11
Z	138.44	69.22	139.65	69.82
Z	138.86	69.43	142.92	71.46
Z	139.22	69.61	146.07	73.04
Z	139.54	69.77	149.10	74.55
Z	139.83	69.92	152.02	76.01
Z	140.09	70.04	154.84	77.42
Z	140.32	70.16	157.56	78.78
Z	140.53	70.26	160.19	80.09
Z	140.71	[illegible]	[illegible]	[illegible]
Z	140.86	[illegible]	[illegible]	[illegible]
Z	141.03	[illegible]	[illegible]	[illegible]
Z	141.17	[illegible]	[illegible]	[illegible]
Z	141.30	[illegible]	[illegible]	[illegible]
Z	141.42	[illegible]	[illegible]	[illegible]
Z	141.50	[illegible]	[illegible]	[illegible]



If you want to learn more about how to improve your PCB production process, you can take test results and physical microsection data and by feeding this information back into the Si8000m discover which production process has most effect on impedance values. With experience you will be able to alter production processes to suit incoming material variation.

Imagine as a PCB fabricator you receive a batch of core material that is all at or around its upper thickness limit. You can use the Si8000m to investigate, if by altering trace dimensions (within their specified range) you can still meet spec.
If more adjustment is required the Si8000m gives you the information you need to go back to the original designer to seek permission to alter traces further. - Whilst this may not always be electrically possible, the designer may find this useful especially if deadlines are tight and waiting for new material could cost a prototype build.



The ever-increasing speeds of modern circuitry demand high quality controlled impedance printed circuit boards. Today's PCB is not just a simple electrical interconnection device, it is a complex, highly specified component in its own right, bringing with it an increased requirement for board design verification prior to manufacture.
In order to maximize performance whilst keeping costs under control many designers specify high performance laminates in a composite stack up along with lower cost base materials. Multiple dielectric boards offer high performance at low cost but do require increased up front simulation.

Multiple dielectric boards offer high performance at low cost but do require increased up front simulation

The Si8000m field solving impedance design system offers advanced field solving methods to model most track designs and is the natural partner of the Polar CITS and RITS manual and automatic Controlled Impedance Test Systems. CITS measurement systems are in use with leading PCB manufactures throughout the world, and Polar is unique in delivering solutions for impedance test and design, along with a comprehensive website packed with resource for the fabricator and designer of impedance controlled boards.

Differential Impedance PCB Structures

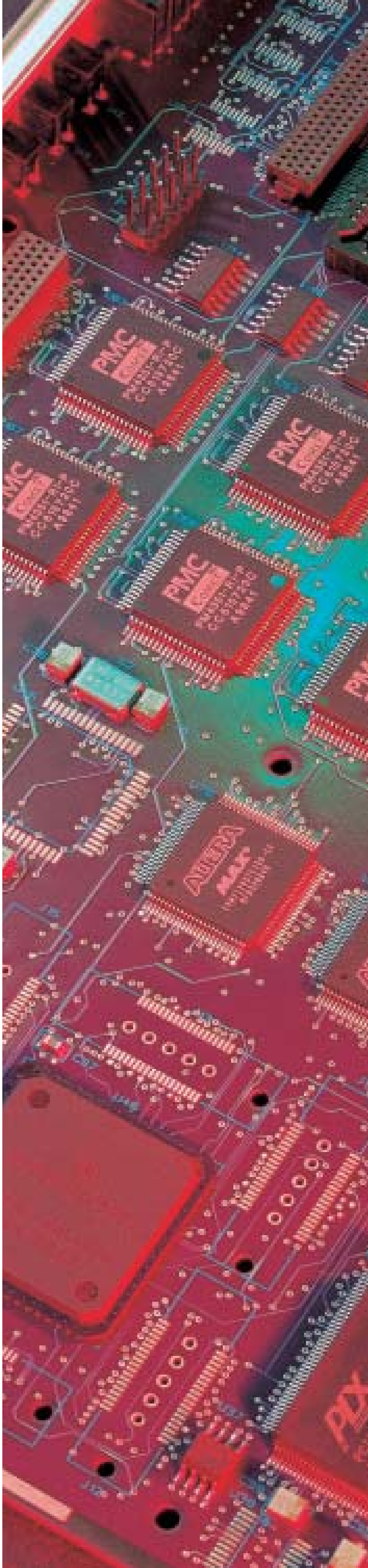
Differential Coplanar Impedance Structures

Single Ended Impedance Modelling

Microstrip and Stripline Constructions

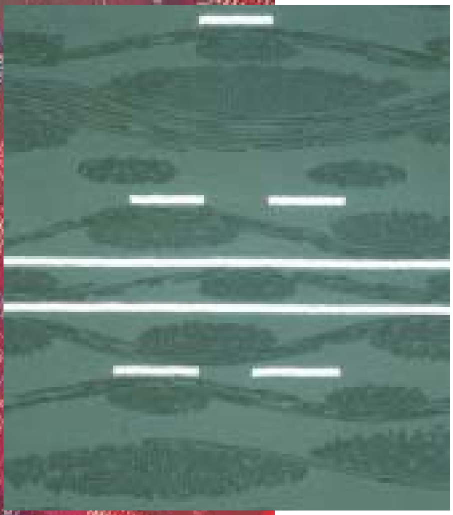
Field Solving by Boundary Element Method - BEM

Extraction of Odd, Even and Common mode impedance



Mils Inches Microns and Millimetres

PCB Designers and fabricators often have to contend with a mix of units, the Si8000m Quicksolver converts these on the fly. Simply click the unit type you need for each dimension and the Quicksolver automatically converts units into a single type. You can also enter the tolerance for each dimension, either as a dimension or as percentage. The Quicksolver will rapidly resolve your potential production variations for you, so you can make an estimate of yield before committing to inventory time and materials.



This illustrates a polished microsection of a typcial glass resin composite structure. This is FR4 but could equally be any woven glass reinforced composite. Glass has a dielectric constant of 6, the resin around 3 With high frequency base materials the resin Er can be even lower. On fine geometry boards with differential traces you need to take into account local variations in the material Er in order to obtain the most accurate prediction of impedance.

When the differential pair or coplanar waveguide is designed with very close spacings, almost all the electric field occurs in the horizontal gap between the traces. This is often resin filled (as shown).
A number of structures in the Si8000m allow you to define the local Er between the traces. Make sure you consider this in order to maximise your first time yields.

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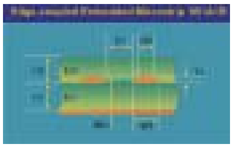
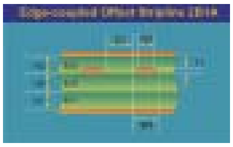
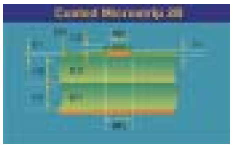
Sample selection of structures - See www.polarinstruments.com for comprehensive list



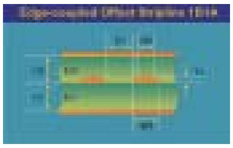
Edge coupled embedded microstrip,
1 substrate below, 1 above plus resin rich region.



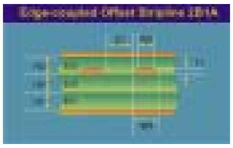
Edge coupled offset stripline
2 substrates below trace, 1 above



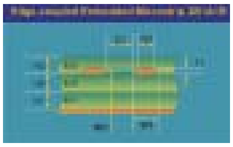
Coated microstrip,
2 substrates plus 2 user definable soldermask layer thicknesses



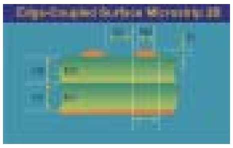
Edge coupled offset stripline
1 substrate below trace, 1 above



Edge coupled offset stripline
2 substrates below, 1 above



Edge coupled embedded microstrip,
2 substrates below, 1 above plus resin rich region.



Edge coupled surface microstrip
with 2 substrates.