SOLDER RELIABILITY SOLUTIONS™, SRS 1.1

PC-BASED SOFTWARE TO BUILD-IN SOLDER JOINT RELIABILITY AND PREVENT WEAR-OUT FAILURES IN THE FIELD.

PRODUCT BROCHURE, PRICES AND ORDERING INFORMATION - JANUARY / MARCH 2007.

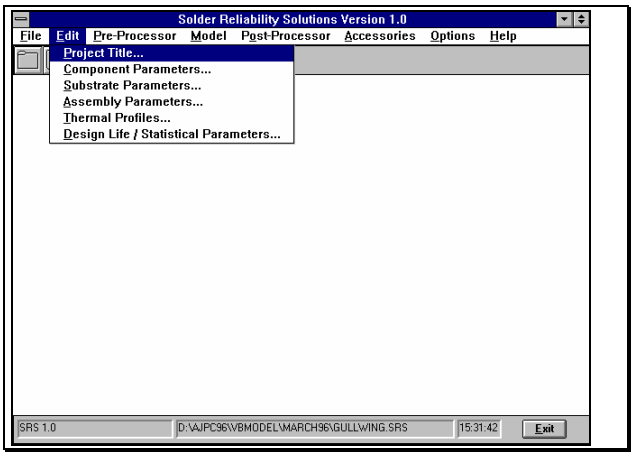
WHY SRS?

Cyclic thermal stress conditions in surface mount assemblies leads to **solder fatigue, a major cause of failure in electronic systems**. To help prevent wear-out failures, the SRS software estimates standard SnPb solder joint fatigue life and enables **building-in reliability in the design and manufacturing stages** of product development. SRS is the PC implementation of thermal stress and life prediction methodologies that capture years of thermal cycling model development across the electronics industry.

FEATURES

- Microsoft Windows™ environment.
- Interactive data entry, Windows™ filing system, Help File.
- Pre-processor and post-processor modules.
- Stress/strain analysis (includes solder creep).
- Statistical life predictions.

SRS is **a PC-based design-for-reliability tool** that enables rapid **"what if" analysis** of the effects of board, component and thermal load parameters on the attachment reliability of near-eutectic tin-lead assemblies.

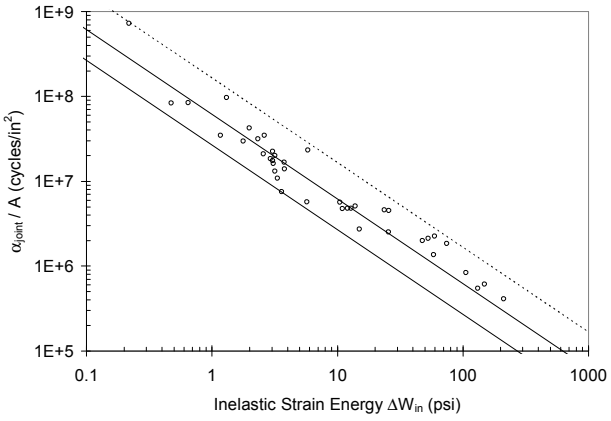


PHYSICAL MODEL

SRS implements **analytical / empirical models** that correlate solder joint fatigue life to cyclic inelastic strain energy **for near-eutectic Sn-Pb assemblies**. The reliability model is validated by over 50 accelerated tests and the correlation of solder joint thermal fatigue lives over **three orders of magnitude.**

Model input includes:

- Component, board and assembly geometry and material properties (CTEs ...).
- Thermal profiles: cold and hot temperatures, dwell times, frequency, including multiple thermal loads.
- Targeted design life; statistical parameters.



Fit of thermal cycling test results to SRS model.

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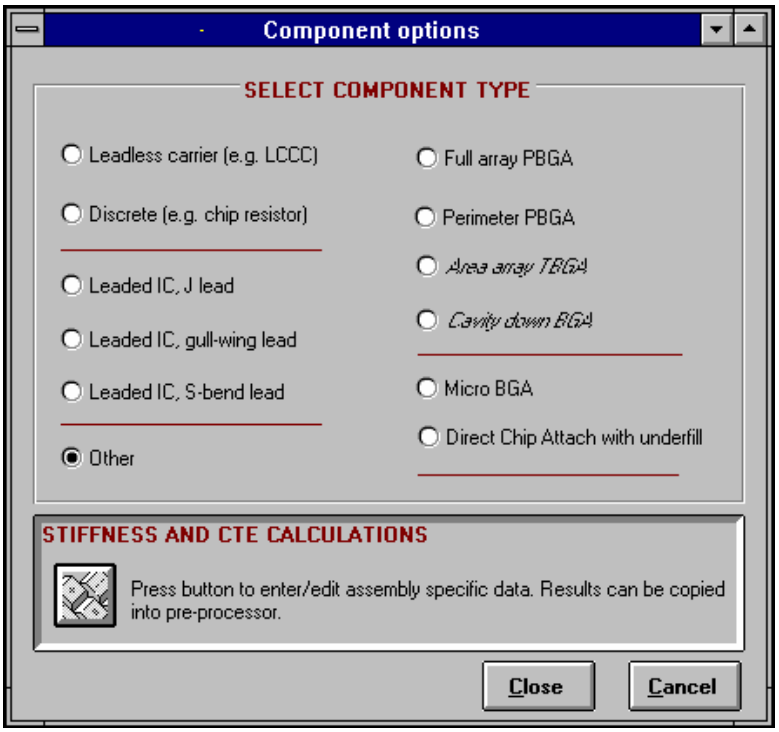
STIFFNESS / COMPONENT OPTIONS

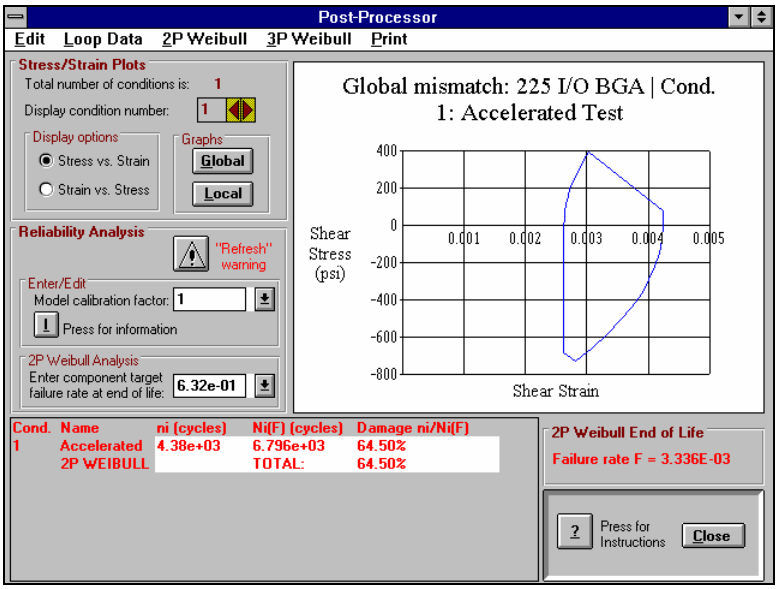
- The assembly stiffness, which accounts for the elastic deformations of the assembly, impacts the solder joint stress / strain response and fatigue life. Design tools are provided to determine stiffness parameters for common families of surface mount components and assemblies.
  - Conventional leadless and leaded components (gull-wing, S, J lead shapes).
  - PBGA: full and perimeter array.
  - DCA /flip-chip with underfill; micro-BGA with compliant layer strain relief.
  - Model also applies to cavity down BGAs.

Note: EPSI offers mechanical analysis services to determine stiffness parameters for less common or specialized components and assemblies.



OUTPUT

- Stress/strain hysteresis loops and tables.
- Cumulative damage distribution (chart and tables).
- Two and three parameter Weibull statistics, failure rates, failure free time.
- Model calibration to fit predicted life to test results.
- Copy plots to printer or clipboard.
- Listing of input data (for pasting into text editor).



SYSTEM REQUIREMENTS

- PC running Microsoft Windows™ 3.1 (or greater), or Mac/PowerPC™ running Insignia SoftWindows™ (version 2.0); 4 Mbytes of RAM, 4 Mbytes of available hard disk space.

ABOUT THIS OFFER

SRS 1.1 is currently offered at a reduced price. Under the terms of this offer, customers get free software support - as defined in page 6 - for one year. Technical support can also be purchased on an hourly basis.

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Shipping and handling (2) – USPS Priority Mail (standard)	US $15 each		
Next day USPS Express Mail delivery (US only)	US $25 each		
Technical / engineering support (see p.6): $175/hour	US $175/hour		

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- A free one hour tutorial to learn how to use the software - please call at your convenience, tutorial will get you up the learning curve fast. This tutorial is not for technical support or review of analysis files.
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Item Designation / Description	Price[1], [2]	Maintenance[3]	TOTAL
SRS 1.1- D3: up to 3 users & installation on up to 3 computers.	US $2900.00	US$575.00	
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SRS 1.1- D12: up to 12 users & installation on up to 12 computers.	US $8700.00	US$2300.00	
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SOFTWARE SUPPORT

Operational software support is available exclusively to qualified, licensed registered users of the software. Software support covers operational use of the SRS software tool per se, installation and computational issues. Software support does not cover engineering, modeling / reliability issues. The latter are addressed under "Technical Support".

TECHNICAL SUPPORT

Technical support covering modeling questions, applications, definitions, interpretation of results, reliability issues, guidelines etc… is available upon request. Please call (973)746-3796 or send e-mail to jpclech@aol.com for price information or to discuss how your specific needs can be addressed. Technical support is available as: on-site training / workshops, or phone / e-mail engineering support via an open purchase order or pre-payment of a set number of support hours at the current 2007 rate of US$175/hour.

PURCHASING OF 4 TO 8 HOURS OF TECHNICAL SUPPORT AT THE TIME OF PURCHASE OF THE SOFTWARE LICENSE IS HIGHLY RECOMMENDED FOR NEW USERS OF THE SRS TOOL. THIS ENSURES A GOOD HEAD-START IN THE SETUP OF YOUR FIRST FEW ANALYSIS FILES AND THE INTERPRETATION OF TEST RESULTS. TECHNICAL SUPPORT IS OFTEN USED, FOR EXAMPLE, TO REVIEW INPUT DATA AND DISCUSS ANALYSIS RESULTS.

FOR TECHNICAL / ENGINEERING SUPPORT, PLEASE INCLUDE NUMBER OF HOURS YOU WISH TO PURCHASE ON ORDER FORM (PAGE 3 OR 4). TECHNICAL SUPPORT IS TYPICALLY VIA E-MAIL OR TELEPHONE. WE KEEP TRACK OF TIME USED AND WILL INFORM YOU WHEN THE PRE-PAID NUMBER OF HOURS HAS BEEN EXHAUSTED. FOR A TYPICAL USER, 4 TO 8 HOURS OF TECHNICAL SUPPORT COVERS A LOT OF GROUND OVER A ONE YEAR PERIOD. UNUSED HOURS CARRY OVER FROM YEAR TO YEAR. TECHNICAL SUPPORT IS FOR NOMINATED USERS OR INDIVIDUALS / COLLEAGUES AUTHORIZED BY THE PURCHASER OF TECHNICAL SUPPORT HOURS.

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WHAT USERS OF THE SOLDER RELIABILITY SOLUTIONS SOFTWARE SAY

COMMENTS PUBLISHED BY USERS OF THE SOLDER RELIABILITY SOLUTIONS SOFTWARE

"PROS:
• Predicts time to first failure (3P Weibull) or any other % failure (2P).
• Computation time Very fast (about 2 sec.)
• Easily handles multiple thermal conditions (Miners rule)
• Inexpensive ($1200).
• Good for examining material/design changes.
CONS:
• Currently used for eutectic Pb/Snsolder.
.....
• Based upon the accuracy, ease of use, and program cost the SRS code appears to be a "best buy"."
R. Wavrik, J. Aragon, J. White, P. Vianco, A. Kilgo and J. Sweet, "Comparison of Solder Fatigue Life Models to Experimental Data", presentation given at 2006 Components for Military & Space Electronics Conference, 10th Annual CMSE Conference, February 6-9, 2006, Los Angeles, CA.

"Simple PC based model (not FEM) which executes quickly...."
"Over 300 part types / board combinations evaluated by the SRS code..."
"SRS code does a good job of predicting time to first failures (also life remaining)" , Wavrik et al., Sandia National Laboratories - US Department of Energy's National Nuclear Security Administration. Ref.: Wavrik, R., Aragon, J., White, J., Vianco, P., Kilgo, A. and Sweet, J.: "Experimental vs. model prediction comparison of solder joint fatigue life for COTS components", in presentation at 2004 International Military & Aerospace / Avionics COTS Conference, Exhibition & Seminar, August 3-5, 2004.

"The SRS model results were substantiated with a life prediction model developed at the University of Colorado", Hunter et al., Storage Technology Corporation & University of Colorado. Ref.: Hunter, B., Subbarayan, G. and Rose, D., "Characterization of PCB expansion using moiré interferometry and the impact of expansion variability on the life of solder joints", Proceedings, InterPACK'99 Conference, EEP-Vol. 26-1, Advances in Electronic Packaging, ASME, June 13-19, 1999, Maui, Hawaii, pp. 875-882.

"The simulation results are in accord with the experimental results, meaning SRS model describes the behavior of the BLP package's solder joint accurately", Choi et al., LG Semicon, Korea. Ref.:Choi, K-S., Kim, Y.-G., Choi, S., Park, I.-S., Lee, J.-H. and Ku, J.-Y., "Solder joint reliability of the BLP package", Proceedings, IPC / SMTA Assembly Expo, Providence, RI, October 24-29, 1998, pp. S19-3-1 - S19-3-6.

"**Today the most popular intermediate and high order models use accumulated strain energy as the correlating parameter to estimate the solder joint life. Figure 4 shows the correlation between calculated strain energy and measured joint fatigue life a/A, where a is the characteristic number of cycles to 63.2% failures and A is the minimum load bearing area in the joint. The strain energy density (AW) in the figure is calculated with the SRS software but the slope is consistent with other strain-energy based models for SMT assembly reliability. This SRS model has been validated with several different components including 116 and 220 I/O ceramic CSPs. The intermediate order models calculate the strain energy in one thermal cycle within a few minutes whereas the high order models (FEM) take from approximately one hour to one day to provide the solution.**" Dr. Savolainen et al., Nokia Group, Helsinki, Finland. Ref.: Savolainen, P. and Tommi Reinikainen, T., "Measuring the manufacturability and reliability of electronic assemblies", Chip Scale Review,Vol. 2, No. 5, November-December 1998, pp. 61-66.

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OTHER INDEPENDENT REVIEWS & COMMENTS

"The Clech SRS (Solder Reliability Solutions) model is widely accepted by industries, and has been implemented as a PC-based design-for-reliability tool that enables quick parametric studies of critical package and board properties", in CMAP Report, University of Toronto, Canada. Ref.: MIE 2004 Term Report, Part II, *Review of Thermal Fatigue Prediction Models*, Center for Microelectronics Assembly and Packaging (CMAP), University of Toronto.

"SRS (Solder Reliability Solution) Models predicted that you would see over 1000 thermal cycles more before failure with a double sided reflow BGA than with a single reflow. Tests actually proved that", S. Gregory, IPC TechNet Forum, July 2003.

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