



- ▶ Ball Semiconductor utilized SoftJin's expertise to develop key components for its software that drives a Maskless Exposure System for IC Package manufacturing
- ▶ SoftJin developed a GUI for both data preparation as well as process control of this machine, using its skills in Qt™
- ▶ SoftJin developed a Gerber to intermediate format converter using its expertise in Computation Geometry operations and algorithms

## Customer

This case study describes SoftJin's engagement with Ball Semiconductor Inc. (BALL), an IC and IC packaging Equipment Company that is developing a Maskless Exposure System for PCB and IC package manufacturing.

## Project Overview

To support their advanced technology, Ball is developing a Maskless Exposure System for production of high resolution Printed Circuit Boards (PCB), display panels, and high-density chip packaging. SoftJin has developed key software components of this system, as shown in Figure 1:

SoftJin developed the Front End Graphical User Interface (GUI) for the Maskless Exposure System, so that the operator gets an integrated view of the whole system for process control. The operator is presented with a Graphical User Interface (GUI), which can be used to view and control various operations of the system.

SoftJin also developed a software module to convert an

input file in Gerber RS274-X format to an intermediate format of BALL's Maskless Exposure system. This intermediate format is a preparatory step for generating the bitmap file which drives the Maskless Exposure System.

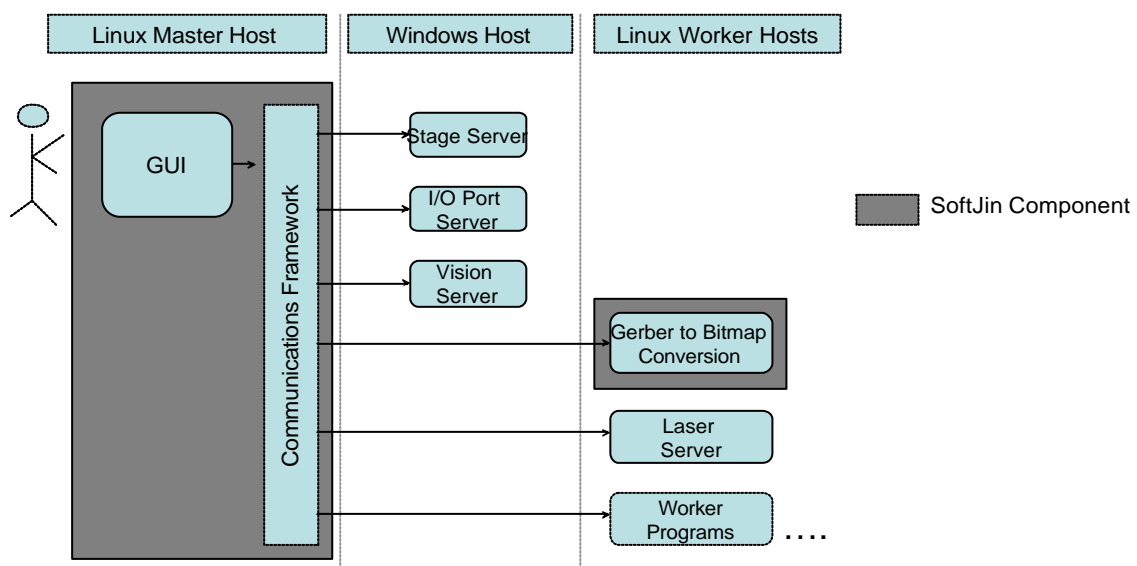
## Front End

Front End GUI is made of about 50 screens as well as a communications framework that handles communication with server-side programs. The server side programs are tightly integrated with hardware components of the system.

GUI, a selection of which is shown in Figure 2, was developed using Qt™ and is targeted at the operator of the machine. The various actions that are supported by this GUI include:

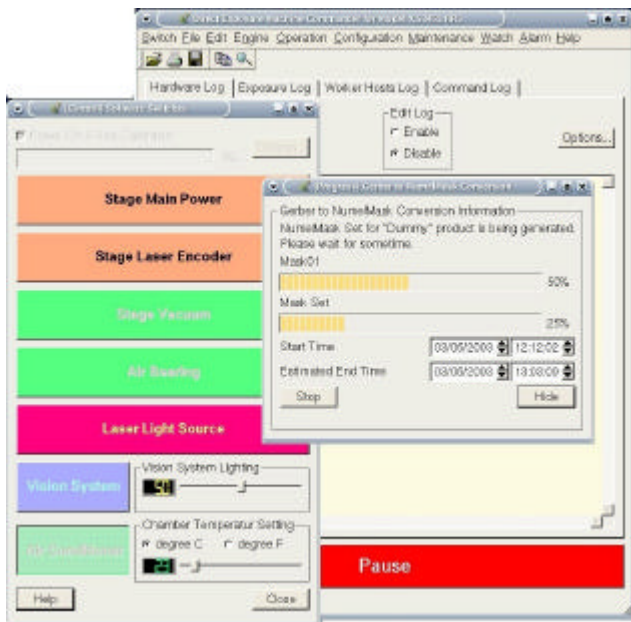
- Login to the system with different privileges
- Administering the system
- Setting up of parameters
- Reviewing system variables
- Initiating the Gerber to Bitmap conversion
- Running, monitoring and terminating the exposure

Figure 1: Ball's Maskless Exposure System Software Components



The operator gets logged messages of the activities that are happening at various parts of the Maskless Exposure System. This includes logged messages of activities of both the software as well as the hardware components. Based on these logged messages, the operator makes decisions and starts/stops a process or alters the conditions of already running operations

**Figure 2 : Front End of Ball Maskless Exposure System**



using interfaces provided by the Front End Framework tool.

The main challenges of this GUI were that it was targeted for use by non-engineering operators and hence it was expected to be extremely user-friendly. Moreover, as the GUI was targeted to be used in the actual production line, it was expected to be extremely reliable and stable. Since the server side programs were being simultaneously developed at Ball, SoftJin team also played a key role in defining the interfaces that enabled parallel development.

## Gerber to Intermediate format conversion

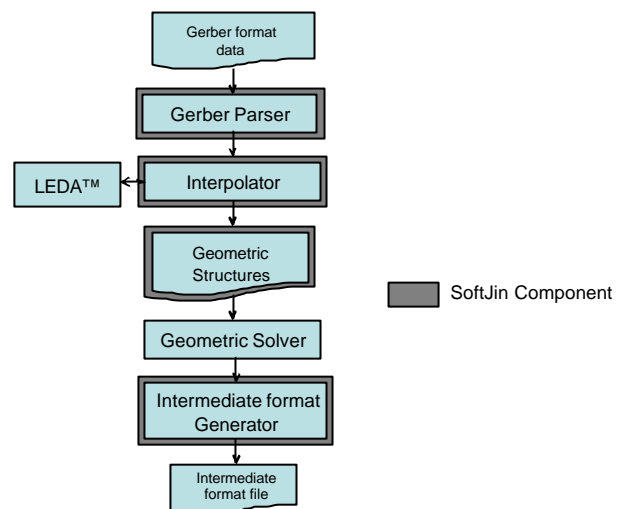
The input accepted by the Maskless Exposure System is the Industry standard Gerber format, which is a description format for package layout data. The data preparation process involved in converting the layout data using geometric operations into an intermediate format is shown in Figure 3. This intermediate format would later be converted into a bitmap format accepted by the Maskless exposure system. Data preparation involves various software components developed by SoftJin, as shown in Figure 3:

- A *Gerber Parser*, developed by SoftJin, which supported the recommended usage of the format. Most of the Gerber Parsers available make very

simplistic assumptions while carrying out *geometric interpolations* for ease in implementation. However, SoftJin's Gerber parser makes no such assumptions and truly represents the Gerber specifications.

- The parser populates an internal *geometric data structure*, developed by SoftJin, to store the parsed geometry information.
- The interpolator then generates the polygon [geometry] structures using the commercially available LEDA™ geometric library.
- These geometric library directives are implemented by a third-party *geometric solver* and a SoftJin developed *Intermediate Format Generator* to generate geometric information in a Ball -specific intermediate format.

**Figure 3 : Gerber to Intermediate format conversion**



The key issue faced by the project team was memory management and this solution was optimized to generate intermediate format files of the size of 10 GB. Testing was carried out by comparison with an alternative flow for the same carried out for the customer by a separate project team at SoftJin- this is a showcase for our processes which ensures that the project teams are completely separated and no code contamination happens.

## Results

The project was completed with extensive testing to ensure that the software was production ready.

This project showcases SoftJin's role in working closely with semiconductor equipment vendors such as BALL, helping them derive significant benefits in terms of access to SoftJin's software capability while they can focus on their core expertise of design and manufacture of the equipment. By developing key software components for BALL's maskless exposure system, SoftJin is enabling BALL to meet the stringent time to market challenges.

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