

## REAL WORLD



Custom SoC World of Toshiba

Real World is a case study initiative designed to recognize customers whose advanced ICs are making a difference in our Custom SoC World.

### CUSTOMER PROFILE

- Global Locate, Inc. is based in San Jose, California
- Market Served: Global positioning systems (GPS) and Assisted-GPS (A-GPS) products and services for wireless devices and networks
- Featured Product: Marlin™ A-GPS Chipset
- Web Site: [www.globallocate.com](http://www.globallocate.com)

### SoC CHALLENGE

- Technical: Lower the active and standby power of the signal processing engine, in tandem with achieving high levels of integration
- Business: Collaborate with a reliable, affordable vendor with leading-edge foundry services and low-power 130 nm technology
- Marketing: Reduce time-intensive process to meet 6-month window

### TOSHIBA SOLUTION

- Core segmentation into several islands to reduce power
- Custom low-height I/Os to reduce die size and cost
- Custom mask logic to turn power off in sleep mode
- Lower cost packaging
- High-yield DFM design flow
- Ultra low-power 130 nm process technology

### ENGAGEMENT RESULTS

- General: First-pass silicon success enabled early product introduction
- Technical: The single-chip SoC allowed further power budget to handset designers enabling them to increase range and battery life
- Business: Opportunity to incorporate A-GPS technology into advanced 3G handsets and smartphones, realized

## Toshiba Foundry Expertise and Ultra Low-Power 130 nm Process Help Global Locate Release Advanced A-GPS Chipset Early

### CONTEXT

Global Locate provides industry-leading A-GPS (Assisted GPS) technology to the mobile wireless sector. The Marlin™ A-GPS Chipset adds location functionality to wireless devices that may already integrate a mobile phone, personal digital assistant (PDA), digital camera or other information appliances. Marlin's small footprint, low cost, and low-power consumption help make location-based services functions possible within a handheld wireless device. Its massively parallel correlation engine enables Marlin to search all possible satellite ranges simultaneously.

### CASE STUDY

### GLOBAL LOCATE AND TOSHIBA

Anxious to exploit the A-GPS market, but cautious of first-time collaborations, Global Locate performed an extensive evaluation of foundries. They concluded that Toshiba's 130 nm business-ready solution—including IP building blocks, deep sub-micron design methodologies, manufacturing leadership in high-yield/high-performance SoCs, expertise in advanced packaging and testing capabilities—reduced design cycle and lowered risk.

- At the outset, Toshiba offered proven, low-power, mature libraries and demonstrated an excellent track record of success.
- Upon culmination, Toshiba had met an aggressive 6-month time-to-market schedule and provided significant engagement cost savings.
- Global Locate's design goal was to lower the active and standby power of the signal processing engine, along with achieving high levels of integration. Toshiba's high-yield DFM design flow and proven 130 nm process technology was used to expedite the development and delivery of an advanced single-chip SoC. This chip allowed further power budget to handset designers enabling them to increase range and battery life.

"Global Locate selected Toshiba because of their state-of-the-art, low-power, 130 nm CMOS process and broad design-services offering. Our engagement with Toshiba resulted in a 'first-spin' success allowing the Marlin chip to come to market ahead of schedule."



— Don Fuchs  
Executive VP, Business Development  
Global Locate, Inc.



### THE CORE IS CURRENCY

To reduce power consumption, Toshiba applied its multi-VDD and multi-Vth libraries and segmented the core into several islands with each island supporting reduced voltages. Mask logic was tuned to turn power off in sleep mode, further extending battery life. The lower power consumption also enabled use of a lower-cost Toshiba package, which favorably reduced board and system costs critical to this application. Power and die size were further reduced with custom designed low-height I/Os.

Using leading EDA tool flows, unique design elements were incorporated ahead of industry. Advanced wire spreading and DFM rules for yield management resulted in higher yields and quick ramp up to volume production. Since Toshiba owns its fabs and develops proprietary silicon processes, Global Locate was not vulnerable to lead times, wafer costs and capacity issues. Greater control over fab access helped achieve a start-to-finish schedule from quality netlist to working prototype in just six months.

“Marlin gives performance improvements orders of magnitude beyond all other A-GPS solutions. Its massively parallel correlation engine allows Marlin to search all possible satellite ranges simultaneously to acquire outdoor satellite signals in a fraction of a second. Toshiba’s first-time silicon success helped us tell that story earlier.”

—Don Fuchs  
Executive VP,  
Business Development  
Global Locate, Inc.



## THE MAGIC IN MARLIN



The Global Locate Marlin™ A-GPS Chipset consists of the Marlin GPS Baseband Processor IC and the GL-LN22™ GPS Integrated Front End IC. Marlin is highly integrated for minimum size and cost, so no other ICs are needed. The GL-LN22 integrates LNA, 2-bit A/D output, and is frequency-synthesizer compatible with virtually all cell phone reference frequencies. All computationally demanding GPS processing occurs in the Marlin baseband processor, thus the host CPU loading and memory requirements of the software are minimal.

The Marlin A-GPS Chipset can provide fixes in “on demand” or “continuous” mode. Global Locate A-GPS is normally in a near-zero power state. When queried by the host CPU it is briefly activated to perform GPS signal measurements. Marlin uses approximately 0.0001% of battery charge per fix.

The greatest challenge that Marlin presented during IC development was consolidation; fitting the entire digital signal processing power into a small footprint within a short period of time. Toshiba’s deep sub-micron process competencies and significant technological lead in delivering production-volume, high-yield 90 nm and 130 nm custom SoCs and ASICs, helped to enable first-pass silicon success.

Toshiba works closely with customers to help differentiate their design. According to company reports, the Marlin is the most innovative A-GPS solution on the market today. Marlin is unique in concept, architecture and implementation. By combining premium accuracy, true worldwide coverage, remarkably low-power consumption, fast time-to-first-fix, and short subsequent fix time, Marlin gives performance improvements orders of magnitude beyond all other A-GPS solutions. For example, all possible satellite ranges can be searched simultaneously due to its massively parallel correlation engine.

As a result, Marlin can acquire outdoor satellite signals in a fraction of a second, with additional rapid integrating of weak signals to enable deep indoor operation.

## TIGHT COLLABORATION. PREDICTIVE RESULTS.

From front-end design flow to back-end layout and production, Toshiba’s collaboration with Global Locate was focused on delivering a predictable, yield-centric, first-time right SoC. Naturally that is the goal of every industry leader working in system-level ICs at 90 nm and 130 nm, but Toshiba’s history of integrating capabilities that perfect customer engagements has long been the arbiter of enduring value. Throughout the entire RTL to GDS design flow, Toshiba worked closely to achieve predictive results.

With strict adherence to Design for Manufacturing (DFM) rules, the use of the latest yield prediction software, tools and manufacturing expertise—Global Locate problems could be solved early. This enabled quick ramp up to high-yield production volumes and low defect densities. Millions of units have been shipped; a testament to the high level of collaborative value.

The Marlin A-GPS Chipset is specifically designed for mobile wireless devices and is incorporated in 3G handsets and smart-phones. More information is available at Global Locate’s web site: [www.globallocate.com](http://www.globallocate.com).

## FOR MORE INFORMATION

Please visit [www.SoCWorld.Toshiba.com](http://www.SoCWorld.Toshiba.com)

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# TOSHIBA

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## Marlin™ A-GPS Chipset Designed for Location-Based Services