Addressing Data Aggregation Communication Challenges in Battery-Operated Environments with GW1NZ FPGA Devices

White Paper

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1 Abstract

Data aggregation communication in battery-powered, space-constrained environments poses unique challenges, particularly in systems where multiple devices need synchronization. GOWIN's GW1NZ FPGA devices present an innovative solution, offering ultra-low power consumption, compact form factors, and versatile capabilities for seamless data aggregation. This white paper explores the features, applications, and advantages of GW1NZ FPGA devices in addressing these challenges.

2 Introduction

Numerous applications are in sync with multiple sensors spread across two or more subsystems. Each subsystem is usually an individual board. These sensor's data need to be collected and added to the base system or main SOC. At the same time, the base system or main SOC needs to send commands or set parameters to these subsystems. These usually utilize low speed protocols such as I2C, UART, SPI, etc and work as sideband communication channels in the system. The traditional method is simply following the protocol and results in many wires being used between the base system and subsystems.

Data aggregation refers to the process of combining information from various sources, thereby minimizing the need for numerous physical network connections between two communicating systems. Aggregate data is high-level data which is acquired by combining individual-level data. By combining the low-speed data and sending the aggregate data through a high-speed channel, it can effectively reduce the number of wires between the base system and subsystems. It also reduces the redundant data and helps lower the system power consumptions. One good example is the OCP DC-SCM project in server applications.

In scenarios demanding data aggregation under battery operation within limited spaces, conventional solutions often struggle due to power constraints and space limitations. These applications encompass a range of devices, including wearables and portables such as AR/VR devices, Smart Glasses, Cell phones, and more. GOWIN's GW1NZ FPGA devices stand out as a pioneering solution, surmounting these challenges with their distinctive features and capabilities.

3 Features of GW1NZ Devices

Ultra-low Power Consumption: The standout feature of GW1NZ devices lies in their ultra-low power characteristics, enabling standby power as low as 28uW and operational power below 10mW. This attribute makes them ideal for battery-operated applications demanding efficiency.

Cost-Efficiency: With the potential for large volume purchases to dip below $0.5/unit, GW1NZ devices offer a cost-effective solution without compromising on performance or functionality.

Compact Form Factor: The diminutive size of GW1NZ devices, as small as 1.8mm x 1.8mm, caters to the needs of handheld, portable, and wearable devices, providing

flexibility in design and integration.

Instant On Capability: Leveraging the LittleBee Flash-based FPGA technology, GW1NZ ensures instant activation, crucial for seamless data synchronization and real-time operations.

Flexible Upgrade Options: The inclusion of the GoConfig IP enables background programming, facilitating easy field upgrades, ensuring adaptability, and future-proofing.

Resource	GW1NZ-1	GW1NZ-2
LUT4	1152	2304
Flip-Flop	864	2304
Shadow SRAM(bits)	4K	18K
Block B-SRAM (bits)	72K	72K
B-SRAM Blocks	4	4
User Flash (Bits)	64K	96K
PLLs	1	1
Max I/O	48	125
Core Voltage ZV	0.9V	0.9V
Core Voltage LV	1.2V	1.2V

Package	Pitch (mm)	Size (mm)	GW1NZ-1	GW1NZ-2
FN24	0.4	3 x 3	18	-
FN32	0.4	4 x 4	25	-
CS16	0.4	1.8 x 1.8	11	-
CG25	0.35	1.8 x 1.8	20	-
QN48	0.4	6 x 6	41	41
CS42F	0.4	2.4 x 2.9	36	-
CS100H	0.4	4 x 4	-	88

4 Typical Market and Applications

The versatile nature of GW1NZ devices finds application in various domains:

Battery-operated Applications: Given their ultra-low power consumption, these FPGAs are well-suited for devices reliant on battery power, ensuring prolonged operation without compromising performance.

High-Volume Consumer Electronics: The cost-efficient nature of GW1NZ devices makes them an attractive choice for high-volume consumer electronics, balancing functionality with affordability.

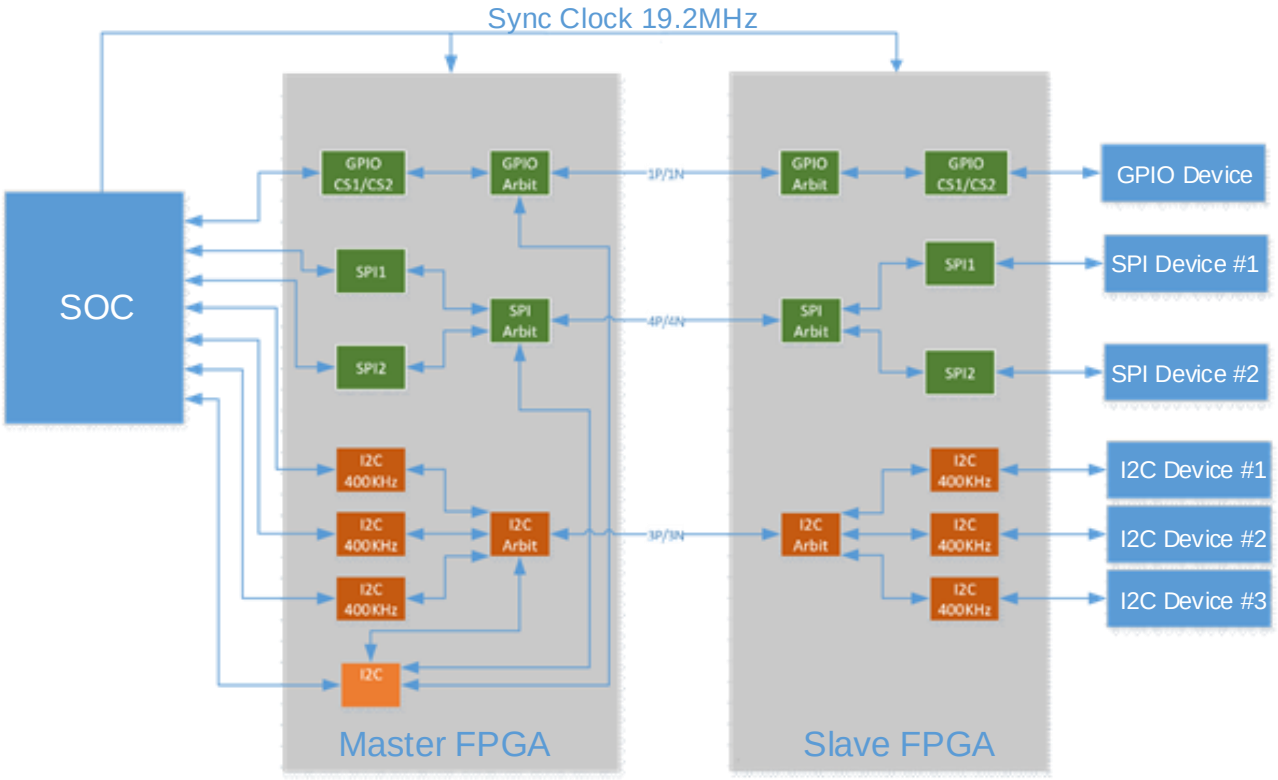
Handheld, Portable, Wearable Devices: Their compact form factor positions these FPGAs as an ideal choice for devices requiring a small footprint, enabling seamless integration into handheld, portable, and wearable gadgets.

Systems Requiring Synchronized Devices: Applications that demand synchronization among multiple cameras or displays benefit from the capabilities of GW1NZ devices,

ensuring smooth data aggregation across the system.

5 One Real World Example

The following diagram described a portable device system.



The performance and power consumption of such system is shown below:

Device	GW1NZ-LV2CS100HC6
Master FPGA Utilization	78% Working Frequency: 32KHz
Slave FPGA Utilization	56% Working Frequency: 32KHz
Total Power Consumption	VCCIO+VCCC+VCC Master and Slave FPGAs: 3.261mW

Device	GW1NZ-LV2CS100HC6
Master FPGA Utilization	78% Working Frequency: 19.2MHz
Slave FPGA Utilization	55% Working Frequency: 19.2MHz
Total Power Consumption	VCCIO+VCCC+VCC Master and Slave FPGAs: 7.9744mW

6 Unique Advantages and Market Positioning

GOWIN's GW1NZ devices hold a competitive edge in the market:

Optimized Design for Thin Control Wires: These FPGAs efficiently handle complex signal transmissions, particularly in scenarios requiring thin control wires across split screens, ensuring robust data aggregation without compromising size.

Leading the Charge in Low Power, High Performance: In an era where cell phone makers seek solutions for efficient data aggregation, GW1NZ devices outshine competitors with their low cost, compact size, low power consumption, and high performance, potentially surpassing ASIC and other FPGA offerings.

Versatility in Multiple Applications: GW1NZ devices demonstrate versatility beyond cell phones, with potential applications in other multi-screen devices, highlighting their wide-ranging market potential

Zero-Power Device and Adaptive Power Modes: Notably, GOWIN's zero-power device and support for multiple voltages make these FPGAs suitable for rest mode operations while excelling in full-power, always-on functionalities like in Opal devices.

GOWIN's GW1NZ family of FPGAs presents an all-encompassing solution to the challenges of data aggregation in battery-operated, space-restricted environments. Their unparalleled combination of low power consumption, cost efficiency, compact form factor, and robust performance positions them as a leading choice in diverse applications requiring seamless data synchronization and aggregation.

7 Conclusion

The GW1NZ family of FPGAs stands as an optimal solution for challenging scenarios where data aggregation is imperative in battery-powered, wearable, and handheld systems. Moreover, the adaptability of these devices to operate at reduced power levels further enhances their suitability for diverse applications.

The GW1NZ series, with its support for 0.9V VCC, surpasses other FPGAs above a 28nm process, offering unprecedented efficiency. Tailored packages like the CS100H and CS42 cater to varying system complexities, providing scalable solutions with reduced power, cost, and size.

Support and Feedback

Gowin Semiconductor provides customers with comprehensive technical support. If you have any questions, comments, or suggestions, please feel free to contact us directly using the information provided below.

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Revision History

Date	Version	Description
2023/12/28	1.0E	Initial version published.
2024/03/08	1.0.1E	The tables in “5 One Real World Example” updated.

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