The Tiva C microcontroller supports multiple power-saving modes to extend battery life and reduce energy consumption. The primary low-power modes are **Sleep**, **Deep Sleep**, and **Hibernation**. Here’s a detailed comparison of these modes:

**Sleep Mode**

**Sleep Mode** is the least power-saving mode among the three. In Sleep mode:

* The processor clock is stopped.
* All peripherals, including the SysTick timer, continue to operate.
* Interrupts can wake the processor from Sleep mode.
* The wake-up time is very short, making it suitable for applications requiring frequent and quick wake-ups.

**Deep Sleep Mode**

**Deep Sleep Mode** offers more significant power savings than Sleep mode. In Deep Sleep mode:

* The processor clock and most of the peripheral clocks are stopped.
* Selected peripherals, such as the Watchdog Timer and the Real-Time Clock (RTC), can continue operating if configured.
* The power consumption is lower than in Sleep mode but higher than in Hibernation mode.
* The wake-up time is longer than Sleep mode but shorter than Hibernation mode.
* The system can be configured to save the state of some peripherals, which allows for a faster and more efficient recovery than Hibernation mode.

**Hibernation Mode**

**Hibernation Mode** provides the maximum power savings. In Hibernation mode:

* Almost all power domains are shut down, including the processor and peripherals.
* Only the Hibernation module and any configured wake-up sources (like an RTC) remain powered.
* The power consumption is extremely low.
* The wake-up time is the longest among the three modes.
* The microcontroller can store some state information (such as the contents of the battery-backed memory) to allow the system to restore its previous state upon waking up.
* Suitable for applications that need to maintain state information across power cycles or very infrequent wake-ups.

**Summary Table**

| **Feature** | **Sleep Mode** | **Deep Sleep Mode** | **Hibernation Mode** |
| --- | --- | --- | --- |
| Processor Clock | Stopped | Stopped | Stopped |
| Peripheral Clocks | Active | Selectively stopped | Stopped |
| Wake-up Sources | Any interrupt | Configured interrupts | RTC, external events |
| Power Consumption | Low | Lower than Sleep | Lowest |
| Wake-up Time | Shortest | Longer than Sleep | Longest |
| State Preservation | Not preserved | Selectively preserved | Preserved (battery-backed memory) |

**Use Cases**

* **Sleep Mode**: Ideal for applications that require frequent wake-ups and need to resume operation quickly, such as in a real-time operating system (RTOS) environment.
* **Deep Sleep Mode**: Suitable for applications where periodic wake-ups are required, but power consumption needs to be minimized more than what Sleep mode offers.
* **Hibernation Mode**: Best for applications that need to maximize battery life with very infrequent wake-ups and can afford the longer wake-up time, such as in remote sensing or long-term data logging applications.

Understanding these modes and their characteristics helps in choosing the right mode for your application based on the trade-offs between power consumption and wake-up time.

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