The comparator control method achieves extremely stable output voltage compared with the voltage/current control method for rapid changes of the load current. Furthermore, Fujitsu's proprietary technology (FPWM) enables the converter to fully synchronize with the clock. This means that the electromagnetic compatibility (EMC), particularly a self-jamming noise for wireless devices, can be reduced.

Introduction

Fujitsu designed its power management ICs with a focus on multi-channel features for portable digital devices. Fujitsu's clock-synchronized comparator control method, the FPWM technology, can be employed in those products. The comparator control method performs switching operations by changing the duty ratio every cycle, and comparing the output voltage against a reference voltage. Therefore, the comparator control method features "high speed load transient response characteristics". However, this method has a problem which oscillation frequency changes according to input/output condition or load current. The FPWM method is compatible with fully synchronized to the clock and high speed load transient response characteristics.

With this technology, voltage fluctuation at the time of rapid load changes can be reduced to less than half, as compared with the conventional method. This technology reduces the EMC for wireless devices, improves the power consumption for portable devices, and meets the recent requirement for high voltage accuracy for the SOC. Furthermore, a built-in Pulse Frequency Modulation (PFM) function improves efficiency under light loads, which is essential for today's energy-efficient products. Both stable-constant-voltage output and high-energy efficiency can be realized with this technology.

Features

- Clock-synchronized comparator control method
- High-speed load transient response
  Less than 20mV voltage fluctuation with the change of 0 to 450mA/2μs (output capacitance 10μF)
**Fast Pulse Width Modulation (FPWM) Technology**

In the automatic PFM/PWM switching mode, this device operates either in PFM or PWM mode, according to the load current.

In the PFM mode, the oscillation frequency is reduced at light load to improve efficiency, increasing the battery life for portable devices.

**PFM function**

In the automatic PFM/PWM switching mode, this device operates either in PFM or PWM mode, according to the load current.

In the PFM mode, the oscillation frequency is reduced at light load to improve efficiency, increasing the battery life for portable devices.

**Various protection functions**

A built-in over-current protection circuit monitors output current enabling engineers to design a highly reliable DC-DC converter.

**Evaluation Board**

Fujitsu provides an evaluation board for single-chip evaluation of the method.

The evaluation board does not support the PFM function.

---

### Key Features

A block diagram is shown in Figure 1, a timing chart in Figure 2, and the load transient response characteristics of this method in Figure 3.

**Clock-synchronized comparator control method**

This method enables stable operation by synchronizing with the internally generated clock. The method provides ultra-high-speed response by periodically comparing and detecting the internal slope voltage and the output voltage, with simultaneous feedback to the comparator. Highly accurate output voltage is achieved because the output ripple voltage required for the conventional comparator method is unnecessary.

In addition, because of the clock-synchronized method, the higher harmonic component of oscillated frequency is stable. Therefore, this comparator control method simplifies the design of wireless devices.

---

**Power supply voltage range:** 2.9V to 5.5V

**Output voltage range:** 0.7V to 1.4V

**Built-in PFM function**

**Switching frequency:** 3.0 MHz to 4.5 MHz

**Built-in over-current protection circuit**

**External phase compensation components, not required**

**Capable of a maximum output current:** 2 Amps

**Built-in Load-independent soft start function**

**Built-in FET for output voltage discharge**

**Ceramic capacitors can be used**

---

**Evaluation Board**

Fujitsu provides an evaluation board for single-chip evaluation of the method.

* The evaluation board does not support the PFM function.

---

**Figure 2 Timing Diagram**

- FET Fixed ON period at low side
- CLK
- VFB
- VSLOPE
- Comp out
- HX
- ILO
- High-side FET gate
- Pch
- Low-side FET gate
- Nch

**Figure 3 Load-Transient response Characteristics**

**Current mode (measured waveform)**

- Io=0mA → 450mA/2μs
- Vo: 20mV/div DC
- Io: 200mA/div
- 10μs
- VIN=3.6V
- Io: 0mA ⇔ 450mA/2μs
- fosc=3MHz
- L=1.5μH (multilayer)
- Co=10μF

**FPWM (measured waveform)**

- Io=0mA → 450mA/2μs
- Vo: 20mV/div DC
- Io: 200mA/div
- 10μs
- VIN=3.6V
- Io: 0mA ⇔ 450mA/2μs
- fosc=3MHz
- L=1.5μH (multilayer)
- Co=10μF