

4-Channel DC/DC Converter IC with Support for Low Voltage MB39A103

A 4-channel DC/DC converter IC with pulse width modulation type (PWM method) while achieving support for low voltage startup (1.7V~). Four built-in channels in a TSSOP-30P/BCC-32P package enable control and soft-startup on each channel.

Product Description

FUJITSU has emphasized the development of power supply ICs for high-performance portable devices such as digital still cameras, and have developed products MB3785A/MB3825A/MB3827/MB3881/MB3883/MB39A102. And now it has developed a 4-channel DC/DC converter IC, MB39A103, which is optimal for use in built-in multi-purpose power supply systems used in high-performance portable devices.

The digital still camera market is expected with production of approximately 29.4 million devices for 2004 in worldwide. Higher performances are being achieved rapidly in such portable devices, there will be a strong demand for further downsized power supply components.

This product is a pulse width modulation type (PWM method) 4-channel DC/DC converter IC which is suitable for up conversion, down conversion and up / down conversion. Achievement of low voltage startup (1.7V~) enables operation from a low voltage. With 4 built-in channels in TSSOP-30P/BCC-32P package, control and soft-start on each channel is possible. Furthermore, a soft-start circuit and a timer latch type short-circuit detection circuit are built in to prevent inrush current when power is turned on and overcurrent at output short-circuit. This product is an optimal power supply for high function, portable devices such as digital still cameras.

Product Features

- Support for down and up / down Zeta conversion (channel 1)
- Support for up and up / down Sepic conversion (channel 2 to channel 4)
- Low startup voltage (channel 4): 1.7V
- Power supply voltage range: 2.5V to 11V

Photo 1 External View



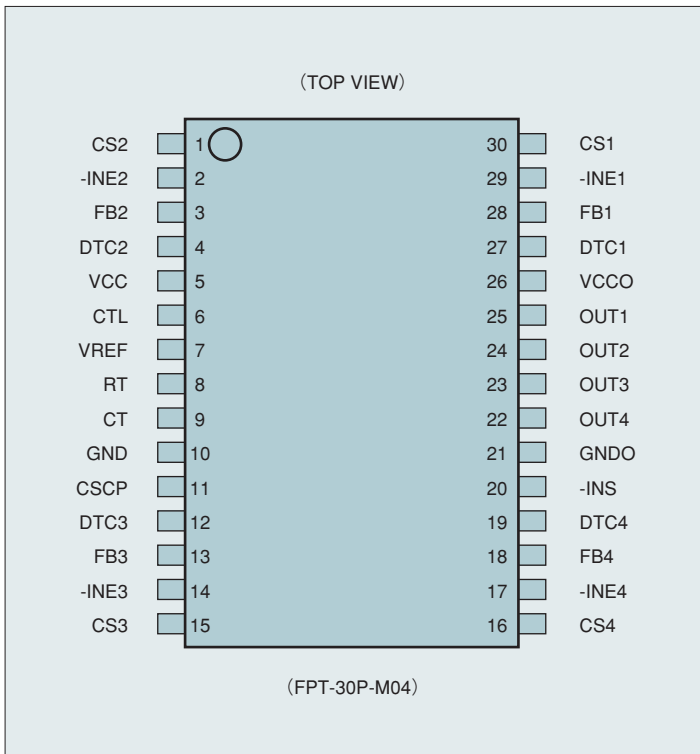
- Reference voltage: $2.0V \pm 1\%$
- Error amplifier threshold voltage: $1.24V \pm 1.5\%$
- Built-in totem pole type output for MOS FET
- Built-in load independent soft-start circuit
- High frequency operation possible: 1MHz (Max.)
- Short-circuit detection from external input is possible with -INS terminal
- Package: TSSOP-30P/BCC-32P

Circuit Configuration

Fig. 1 and 2 show the pin assignments, and Fig. 3 shows the block diagram.

This product consists of function blocks described in the following section.

Figure 1 Pin Assignments (TSSOP-30P)



DC/DC Converter Function

Reference Voltage Block (Ref)

The reference voltage circuit generates a temperature — compensated reference voltage (2.0V Typ.) using the voltage supplied from power supply terminal, and it is used as the reference voltage for the IC's internal circuit.

In addition, the reference voltage can be used to supply a load current of up to 1mA to an external device via the VREF terminal.

Triangular Wave Oscillator Block (OSC)

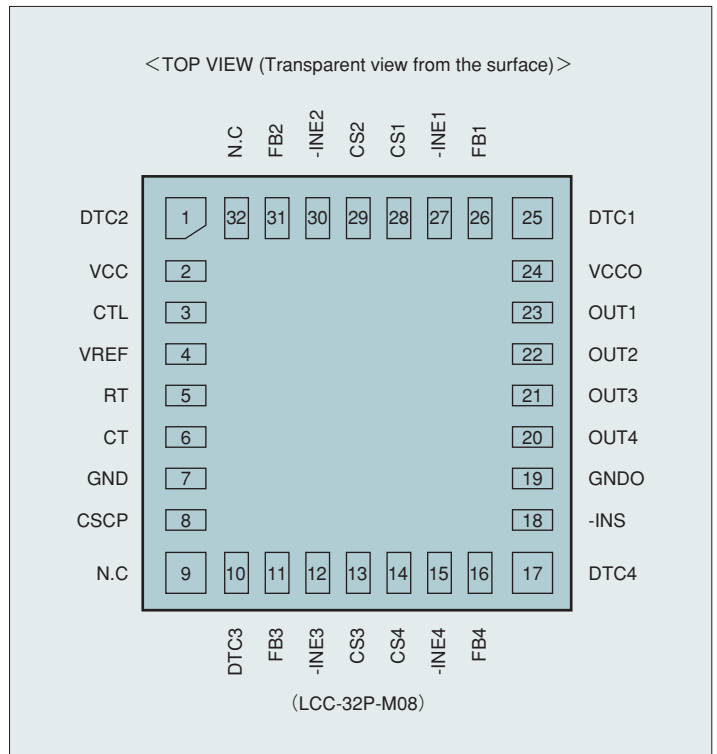
A triangular wave form with amplitude 0.4V to 0.9V is generated from CT terminal by connecting capacitor and resistor for timing on CT and RT terminals respectively.

The triangular wave oscillation waveform is input to the PWM comparator in the IC.

Error Amplifier Block (Error Amp)

The error amplifier is an amplifier which detects the DC/DC converter output voltage and outputs the PWM control signal. Since optional loop gain can be specified through connection of feedback resistor and capacitor to the inverted input terminal from output terminal of the error amplifier, a

Figure 2 Pin Assignments (BCC-32P)

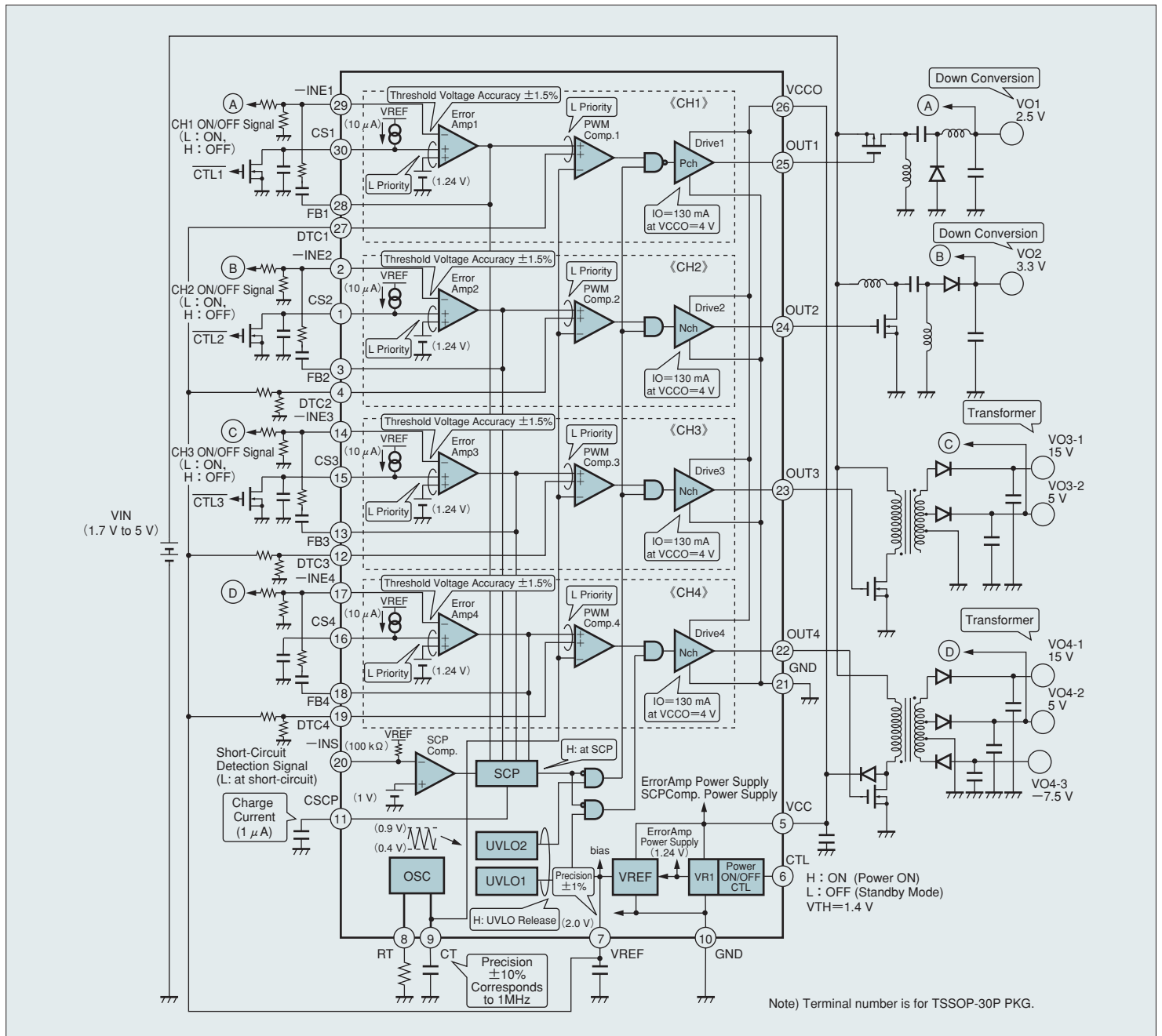


stable phase compensation against the system is ensured.

Connection of a capacitor for soft-start to CS1 terminal to CS4 terminal which are the non-inverted input terminals of the error amplifier prevents the inrush current at power

start-up. Performing soft-start detection with error amplifier enables soft-start operation in a constant time independent of DC/DC converter output load.

Figure 3 Block Diagram



PWM Comparator Block (PWM Comp.)

This is a voltage-pulse width modulator that controls the output duty depending on input / output voltage. The output transistor is turned ON while error amplifier output voltage and DTC voltage are higher than triangular wave voltage.

Output Block (Drive)

The output circuit is constructed in totem pole style and is capable of driving external Pch MOS FET (channel 1) and Nch MOS FET (channel 2 to channel 4).

Channel Control Function

ON / OFF of each channel is specified by voltage specification at CTL terminal and each CS terminal.

Table 1 shows the ON / OFF setting conditions.

Protection Circuit Function

Timer Latch Short-Circuit Protection Circuit Block (SCP, SCP Comp.)

The short-circuit detection comparator detects the level of error amplifier output voltage. When the error amplifier output voltage on any channel exceeds the short-circuit detection voltage, the timer circuit operates and starts charging the capacitor CSCP externally connected to CSCP terminal. When capacitor voltage reaches approximately 0.70V, output transistor is turned OFF and the dead time is set to 100%.

Furthermore, short-circuit detection from an external short-circuit detection comparator is possible using the -INS terminal. When the protection circuit operates, latch is released if power is turned ON again or if the CTL terminal is set to "L" level and the VREF terminal voltage becomes 1.3V (Min.) or less.

Undervoltage Lockout Circuit Block (UVLO)

In the transient state at normal power start-up or during momentary drops in the power supply voltage, control IC malfunction may be induced, which can lead to system damage or deterioration. To prevent such malfunction, the undervoltage lockout circuit detects decrease in internal reference voltage level and turns OFF the output transistor to set the dead time to 100% and maintain the CSCP terminal to "L" level at the same time. If the power supply voltage exceeds the threshold voltage of the undervoltage lockout circuit, the system will restore itself.

Soft-Start Function

Soft-Start Circuit Block (CS)

By connecting capacitors for soft-start to the CS1 terminal to CS4 terminal which are the non-inverted input terminals of the error amplifier, inrush current at power start-up can be prevented. Performing soft-start detection with the error amplifier enables soft-start operation in a constant time independent of DC/DC converter output load. *

Table 1 ON/OFF Setting Conditions for Each Channel

CTL	CS1	CS2	CS3	CS4	Power	CH1	CH2	CH3	CH4
L	—*	—*	—*	—*	OFF	OFF	OFF	OFF	OFF
H	GND	GND	GND	GND	ON	OFF	OFF	OFF	OFF
H	HiZ	GND	GND	GND	ON	ON	OFF	OFF	OFF
H	GND	HiZ	GND	GND	ON	OFF	ON	OFF	OFF
H	GND	GND	HiZ	GND	ON	OFF	OFF	ON	OFF
H	GND	GND	GND	HiZ	ON	OFF	OFF	OFF	ON
H	HiZ	HiZ	HiZ	HiZ	ON	ON	ON	ON	ON

* : Undefined