

## SMALL PACKAGE PFM CONTROL STEP-UP DC/DC CONVERTER

### ■ Introduction

The ZC5100 Series is a CMOS PFM-control step-up switching DC/DC converter that mainly consists of a reference voltage source, an oscillator, and a comparator. The PFM controller allows the duty ratio to be automatically switched according to the load (light load: 50%, high output current: 75%), enabling products with a low ripple over a wide range, high efficiency, and high output current. With the ZC5100 Series, a step-up switching DC/DC converter can be configured by using an external coil, capacitor, and diode. The built-in MOS FET is turned off by a protection circuit when the voltage at the LX pin exceeds the limit to prevent it from being damaged. This feature, along with the mini package and low current consumption, makes the ZC5100 Series ideal for applications such as the power supply unit of portable equipment.

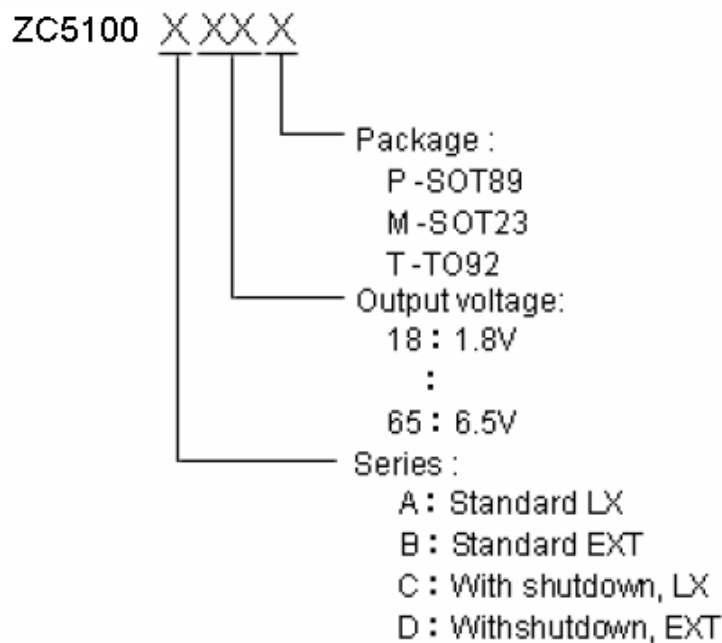
### ■ Applications

- Power supply for portable equipment such as digital cameras, electronic notebooks, and PDAs
- Power supply for audio equipment such as portable CD/MD players
- Constant voltage power supply for cameras, video equipment, and communications equipment
- Power supply for microcomputers

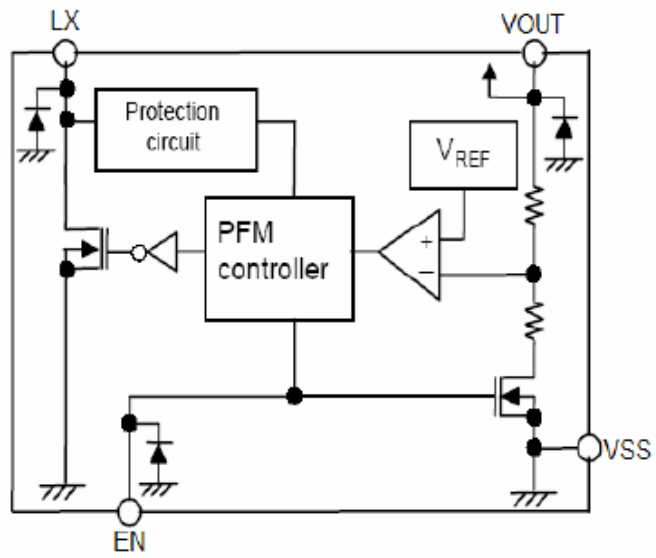
### ■ Features

- Low voltage operation: Startup at 0.9 V min. ( $I_{OUT} = 1$  mA) guaranteed
- Duty ratio: 66/78%, builtin auto switching type PFM controller
- External parts: Coil, capacitor, diode
- Output voltage: Settable to between 1.8 to 6.5 V in 0.1 V steps
- Accuracy of  $\pm 2\%$
- High efficiency:  $\pm 85\%$  (typ.)
- Standard function (product type A)
- Shutdown function (product type C、D)
- External transistor type available (product type B、D)

### ■ Ordering Information



■ Block Diagrams



Pin Assignment

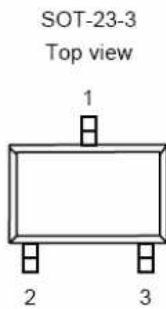


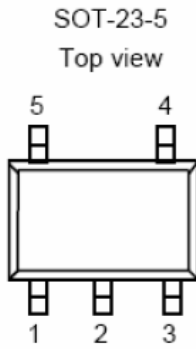
Table 1 ZC5100A Series (SOT-23-3 PKG)

Pin No.	Pin Name	Functions
1	V <sub>OUT</sub>	Output voltage pin
2	V <sub>SS</sub>	GND pin
3	LX	External inductor connection pin

Table 2 ZC5100B Series (SOT-23-3 PKG)

Pin No.	Pin Name	Functions
1	V <sub>OUT</sub>	Output voltage pin
2	V <sub>SS</sub>	GND pin
3	EXT	External transistor connection pin

Table 3 ZC5100C Series (SOT-23-5 PKG)



Pin No.	Pin Name	Functions
1	EN	Shutdown pin “H”: Normal operation “L”: Step-up stopped
2	V <sub>OUT</sub>	Output voltage pin
3	NC	(N.C.)
4	V <sub>SS</sub>	GND pin
5	LX	External inductor connection pin

Table 4 ZC5100D Series (SOT-23-5 PKG)

Pin No.	Pin Name	Functions
1	EN	Shutdown pin “H”: Normal operation “L”: Step-up stopped
2	V <sub>OUT</sub>	Output voltage pin
3	NC	(N.C.)
4	V <sub>SS</sub>	GND pin
5	EXT	External transistor connection pin

## ■ Absolute Maximum Ratings

(Unless otherwise specified, T<sub>a</sub>=25 °C)

Parameter	Symbol	Ratings	Unit	
V <sub>OUT</sub> pin voltage	V <sub>OUT</sub>	V <sub>SS</sub> -0.3 ~ V <sub>SS</sub> +10	V	
EN pin voltage	EN	V <sub>SS</sub> -0.3 ~ V <sub>SS</sub> +10	V	
LX pin voltage	V <sub>LX</sub>	V <sub>SS</sub> -0.3 ~ V <sub>SS</sub> +10	V	
LX pin current	I <sub>LX</sub>	1000	mA	
Power dissipation	SOT-23-3	PD	250	mW
	SOT-23-5		250	mW
	SOT-89-3		500	mW
Operating temperature	T <sub>opr</sub>	-40 ~ +85	°C	
Storage temperature	T <sub>stg</sub>	-40 ~ +125	°C	

## ■ Electrical Characteristics

(Unless otherwise specified,  $T_a = 25\text{ }^\circ\text{C}$ )

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
Output voltage	$V_{OUT}$	—	$V_{OUT(S)} \times 0.98$	$V_{OUT}$	$V_{OUT(S)} \times 1.02$	V	
Input voltage	$V_{IN}$	—	—	—	10	V	
Operation start voltage	$V_{ST1}$	$I_{OUT} = 1\text{ mA}$	—	—	0.9	V	
Oscillation start voltage	$V_{ST2}$	No external parts, voltage applied to $V_{OUT}$ LX pulled up to $V_{OUT}$ via $300\Omega$ resistor	—	—	0.8	V	
Current consumption 1	$I_{SS1}$	$V_{OUT} = 0.95 \times V_{OUT}$	$V_{OUT}: 3.0\text{V}$	—	30	40	$\mu\text{A}$
			$V_{OUT}: 5.0\text{V}$	—	50	60	$\mu\text{A}$
Current consumption 2	$I_{SS2}$	$V_{OUT} = V_{OUT} + 0.5\text{ V}$	—	6	10	$\mu\text{A}$	
Current consumption during shutdown	$I_{SSS}$	$V_{EN} = 0\text{ V}$	—	—	0.5	$\mu\text{A}$	
Switching current	$I_{SW}$	$V_{LX} = 0.4\text{ V}$	100	200	—	mA	
Switching transistor leakage current	$I_{SWQ}$	No external parts, $V_{LX} = V_{OUT} = 10\text{ V}$ , $V_{EN} = 0\text{ V}$	—	—	0.5	$\mu\text{A}$	
Line regulation	$\Delta V_{OUT1}$	$V_{IN} = 0.4 \times V_{OUT} \sim 0.6 \times V_{OUT}$	—	20	50	mV	
Load regulation	$\Delta V_{OUT2}$	$I_{OUT} = 10\text{ }\mu\text{A} \sim 50\text{mA}$	—	20	50	mV	
Maximum Oscillation frequency	$f_{OSC}$	$V_{OUT} = 0.95 \times V_{OUT}$ , measure waveform at LX pin	—	100	—	kHz	
Duty ratio 1	Duty1	$V_{OUT} = 0.95 \times V_{OUT}$ , measure waveform at LX pin	70	78	85	%	
Duty ratio 2	Duty2	Measure waveform at LX pin with light load	—	66	—	%	
Efficiency	EFFI	—	—	85	—	%	
Shutdown pin input voltage	$V_{SH}$	$V_{OUT} = 0.95 \times V_{OUT}$ , judge oscillation at LX pin	0.75	—	—	V	
	$V_{SL1}$	$V_{OUT} = 0.95 \times V_{OUT}$ , judge stop at LX pin	—	—	0.3	V	
Shutdown pin input current	$I_{SH}$	$V_{EN} = 10\text{V}$	-0.1	—	0.1	$\mu\text{A}$	
	$I_{SL}$	$V_{EN} = 0\text{V}$	-0.1	—	0.1	$\mu\text{A}$	

Remark:  $V_{IN} = V_{OUT(S)} \times 0.6$  applied,  $I_{OUT} = V_{OUT(S)} / 250\ \Omega$

Shutdown function built-in type: EN pin is connected to  $V_{OUT}$

$V_{OUT(S)}$  specified above is the set output voltage value, and  $V_{OUT}$  is the typical value of the actual output voltage.

■ Standard Circuits

Component: Inductor: 47uH(Sumida)

Diode: IN5817、IN5819

Capacitor: 47uF/16V(Tantalume type)

Transistor: 2SD1628G、2SD3279

NMOS: XP151、XP161

Base Resistor(Rb): 1K Ω

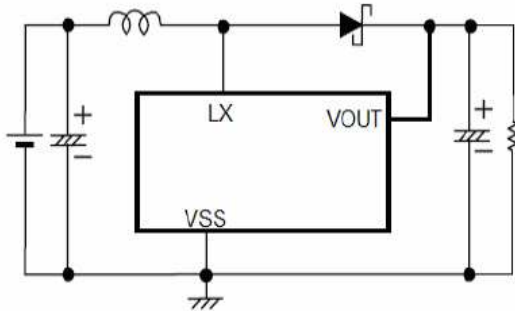
Base Capacitor(Cb): 2200pF

R<sub>FB</sub>: Set up so that  $R_{FB1}/R_{FB2} = V_{out} - 1$  ( $V_{out}$ =set-up output voltage).

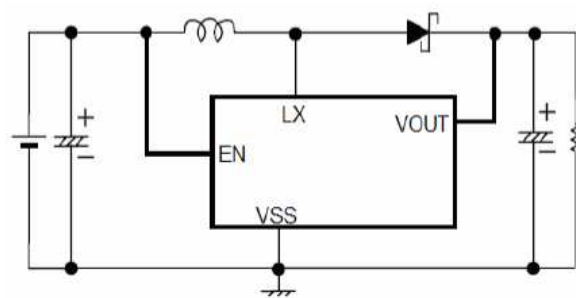
Please use with  $R_{FB1} + R_{FB2} \leq 2M \Omega$

C<sub>FB</sub>: Set up that  $F_{zfb} = 1 / (2 \times \pi \times C_{FB} \times R_{FB1})$  is within the Adjustments necessary in respect of L, C<sub>L</sub>.

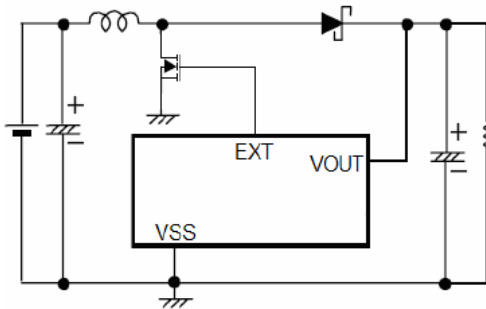
1、ZC5100A Circuits



2、ZC5100C Circuits



3、ZC5100B Circuits



4、ZC5100D Circuits

