

ZT7103

High Efficiency Step Down DC/DC Converter

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■ This data sheet is subject to change without notice.

REVISION HISTORY

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FEATURES

- 800mA output current
- Current mode operation
- High efficiency up to 95%
- Shutdown current < 1μA
- 2.5V to 6V supply voltage
- Over temperature protection
- Constant frequency operation
- Low quiescent current < 200μA
- Full duty ratio, 0 – 100% in dropout
- RoHS Compliant and Lead (Pb) Free

APPLICATIONS

- Cellular phones
- PDAs and smart phones
- MP3 players
- Digital still cameras
- Slim-type DVD
- Wireless and DSL card
- Microprocessors and DSP core supplies
- Portable instruments

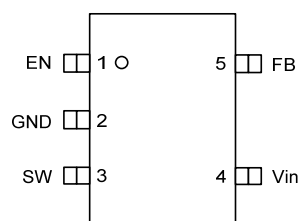
ORDERING INFORMATION

PART	PACKAGE	Output	Ship, Quantity
ZT7103S	SOT25	ADJ	Tape and Reel, 3000
ZT7103T	TSOT25	ADJ	Tape and Reel, 3000
ZT710312S	SOT25	1.2V	Tape and Reel, 3000
ZT710318S	SOT25	1.8V	Tape and Reel, 3000

DESCRIPTION

ZT7103 is a high efficiency step down DC/DC converter operated with current mode and constant frequency. The internal switch and synchronous rectifier are integrated for high efficiency. External Schottky diodes are not required. The supply current is only 200μA during operation and drops to less than 1μA in shutdown. ZT7103 can supply 800mA of load current from 2.5V to 6V supply voltage. The output voltage can be regulated as low as 0.6V. The switching frequency is set at 1.4MHz, allowing the use of small surface mount inductors and capacitors. It can run 100% duty cycle for low dropout application. ZT7103 is available in a low profile SOT25 and TSOT25 package.

Pin Configuration



Absolute Maximum Rating

Vin to GND	-0.3V to +6.5V
SW Voltage to GND	-0.3V to Vin+0.3V
EN Voltage to GND	-0.3V to Vin
FB Voltage to GND	-0.3V to Vin
SW Peak Current	1.7A
Operating Temperature Range	-40°C to +85°C
Maximum Junction Temperature	+125°C
Storage Temperature Range	-65°C to 150°C
Lead Temperature (Soldering 10s)	+260°C
ESD Classification	Class 2

CAUTION: Stresses above those listed in “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

Package Thermal Characteristics

SOT25:	
Thermal Resistance, θ_{JA}	97.2°C/W
Thermal Resistance, θ_{JC}	93.04°C/W
TSOT25:	
Thermal Resistance, θ_{JA}	96.16°C/W
Thermal Resistance, θ_{JC}	61.81°C/W

Pin Description

SOT Pin	TSOT Pin	Symbol	Description
1	1	EN	Enable control input pin
2	2	GND	Ground pin
3	3	SW	Power switch output
4	4	Vin	Main supply pin
5	5	FB	Voltage feedback pin

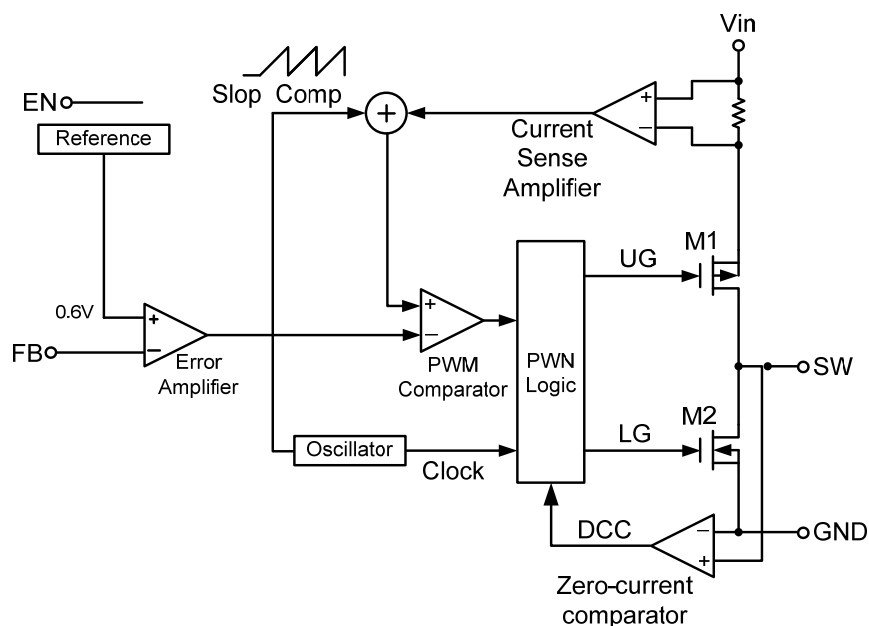
Electro-Static Discharge Sensitivity



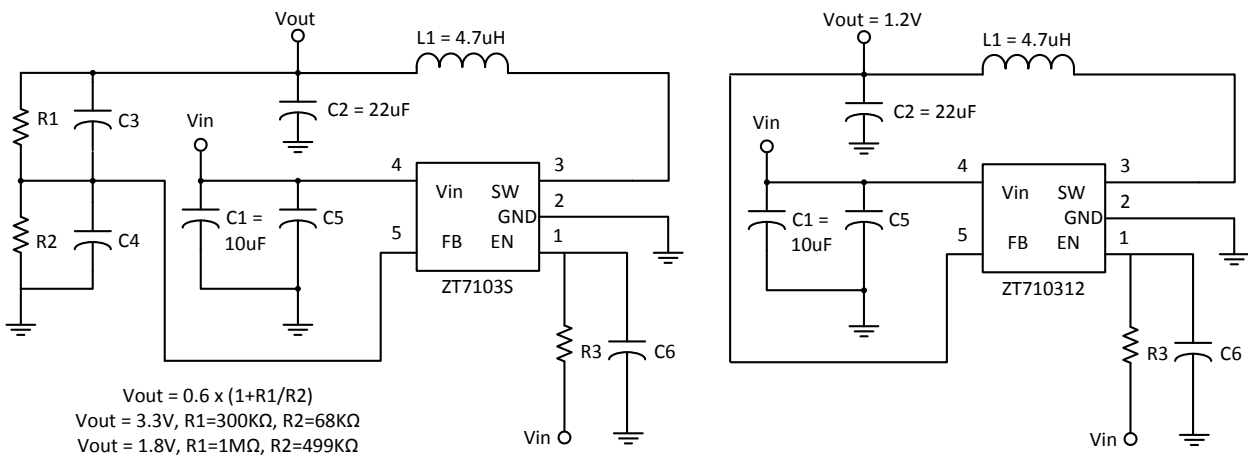
This integrated circuit can be damaged by ESD.

It is recommended that all integrated circuits be handled with proper precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure.

Block Diagram



Typical Application Circuit (Right: Fixed Output Voltage, Left: Adjustable Output Voltage)



*Passive components not specified values in the above figure are optional.

Electrical Specifications

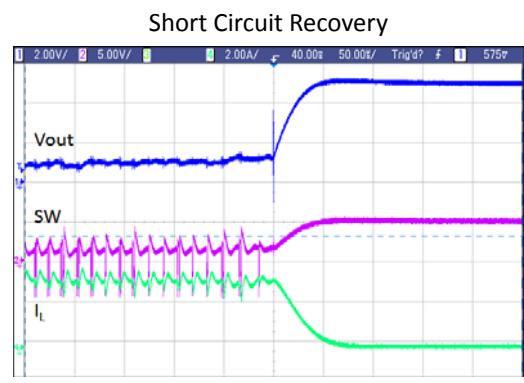
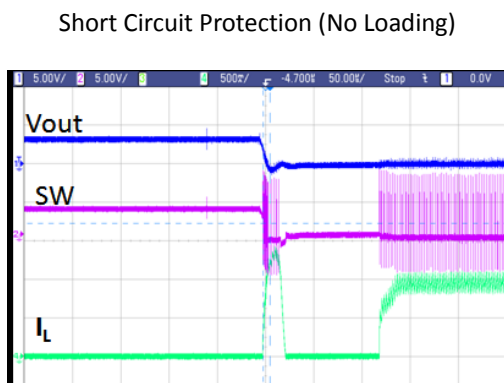
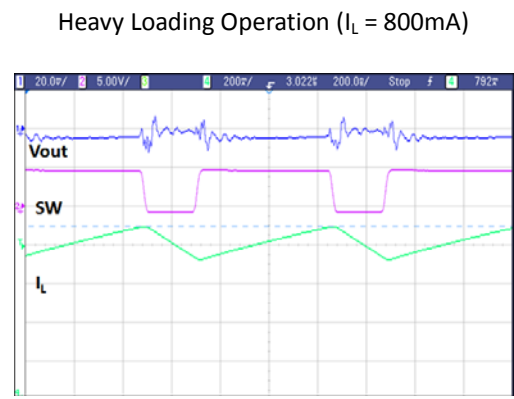
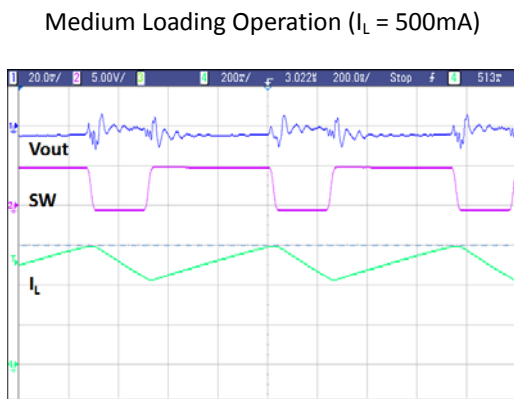
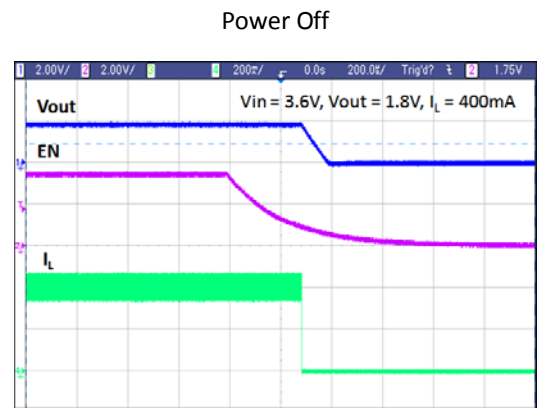
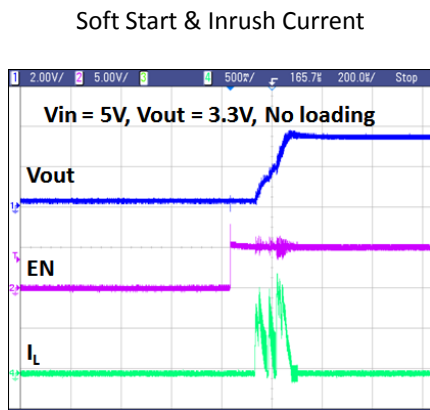
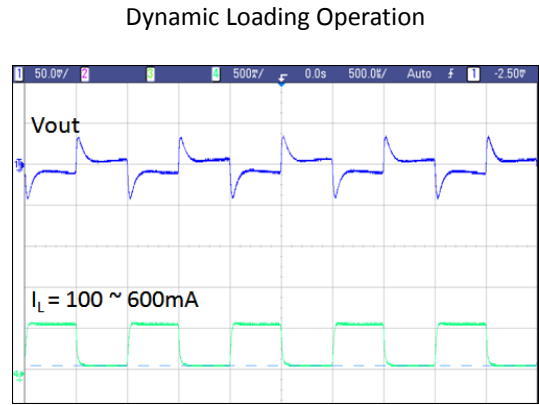
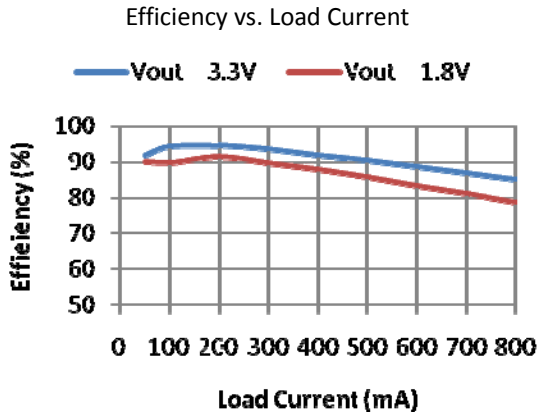
($T_A=0^\circ\text{C}$ to 70°C , $V_{in}=+3.6V$, Typical values are at $T_A=+25^\circ\text{C}$, unless otherwise noted.)

PARAMETER	Symbol	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Supply Voltage	V_{in}		2.5		6	V
Feedback Current	I_{FB}		-30	0.5	30	nA
Regulated Feedback Voltage	V_{FB}	$-40^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$	0.582	0.6	0.618	V
Reference Voltage Line Regulation	ΔV_{FB}	$V_{in} = 2.5V$ to $6V$		0.04	0.4	%V
Output Voltage Line Regulation	ΔV_{OUT}	$V_{in} = 2.5V$ to $6V$		0.04	0.4	%V
Output Voltage Load Regulation	V_{LR}			0.5		%
Output Range (Fixed Voltage)	V_{OUT}	$V_{in} = 2.5V$ to $6V$, $V_{OUT} = 1.2V$	1.164	1.2	1.236	V
Output Range (Fixed Voltage)	V_{OUT}	$V_{in} = 2.5V$ to $6V$, $V_{OUT} = 1.8V$				V
Shutdown Current	I_S	$V_{EN} = 0V, V_{in} = 6V$		0.01	1	μA
Quiescent Current	I_Q	$V_{EN} = V_{in}, V_{FB} = 0.65V$ No Switching		200		μA
SW Leakage Current	I_{LEAK}	$V_{EN} = 0V, V_{FB} = 0.65V$ $V_{SW} = 0V$ or $6V$	-1		1	μA
PMOSFET On Resistance*	$R_{DS(ON)P}$	$I_{SW} = 100mA$		0.35		Ω
NMOSFET On Resistance*	$R_{DS(ON)N}$	$I_{SW} = -100mA$		0.24		Ω
PMOSFET Current Limit*	I_{PCL}	Duty cycle = 100% Current Pulse Width < 1ms	0.8	1.1	1.5	A
Oscillator Frequency	F_{OSC}		1.12	1.40	1.68	MHz
Thermal Shutdown Threshold*	T_S			145		$^\circ\text{C}$
EN High Level Input Voltage	V_{ENH}	$-40^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$	1.1			V
EN Low Level Input Voltage	V_{ENL}	$-40^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$			0.3	V
EN Input Current	I_{EN}	$V_{EN} = 0V$ to V_{in}	-1		1	μA

* Guaranteed by design not for test

TYPICAL CHARACTERISTICS

($V_{in} = 5V$, $V_{out} = 3.3V$, $C_{in} = 10\mu F$, $C_{out} = 22\mu F$, $L = 4.7\mu H$, $T_A = 25^\circ C$, unless otherwise noted)



FUNCTIONAL DESCRIPTION

Overview

The ZT7103 is a constant frequency current mode PWM step down converter. ZT7103 is optimized for low voltage, Li-ion battery, powered applications where high efficiency and small size are critical. ZT7103 uses an external resistor divider to set the output voltage from 0.6V to 6V. The device integrates both a main switch and a synchronous rectifier, which provides high efficiency and eliminates an external Schottky diode. ZT7103 can achieve 100% duty cycle. The duty cycle D of a step down converter is defined as:

$$D = T_{ON} \times F_{OSC} \times 100\% \approx \frac{V_{OUT}}{V_{IN}} \times 100\%$$

Where T_{ON} is the main switch on time, f_{OSC} is the oscillator frequency (1.4MHz), V_{OUT} is the output voltage and V_{IN} is the input voltage.

Current Mode PWM Control

Slope compensated current mode PWM control provides stable switching and cycle-by-cycle current limit for superior load and line response and protection of the internal main switch and synchronous rectifier. ZT7103 switches at a constant frequency (1.4MHz) and regulates the output voltage. During each cycle the PWM comparator modulates the power transferred to the load by changing the inductor peak current based on the feedback error voltage. During normal operation, the main switch is turned on for a certain time to ramp the inductor current at each rising edge of the internal oscillator, and switched off when the peak inductor current is above the error voltage. When the main switch is off, the synchronous rectifier will be turned on immediately and stay on until either the next cycle starts or the inductor current drops to zero. The device skips pulses to improve efficiency at light load.

Dropout Operation

ZT7103 has allows the main switch to remain on for more than one switching cycle and increases the duty

cycle while the input voltage is dropping close to the output voltage. When the duty cycle reaches 100%, the main switch is held on continuously to deliver current to the output up to the P MOSFET current limit. The output voltage then is the input voltage minus the voltage drop across the main switch and the inductor.

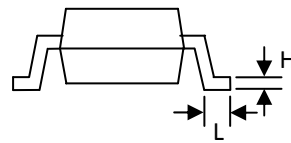
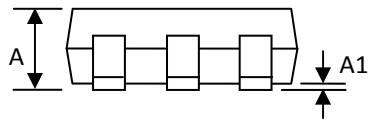
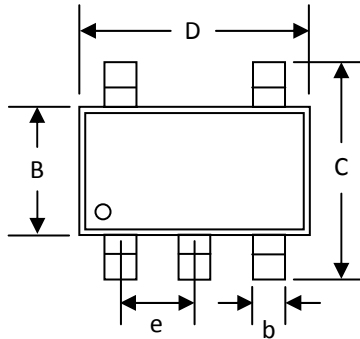
Short Circuit Protection

The ZT7103 has short circuit protection. When the output is shorted to ground, the oscillator frequency is reduced to prevent the inductor current from increasing beyond the P MOSFET current limit. The frequency will return to the normal values once the short circuit condition is removed and the feedback voltage reaches 0.6V.

Maximum Load Current

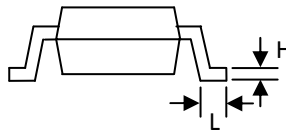
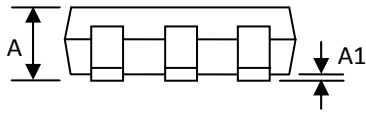
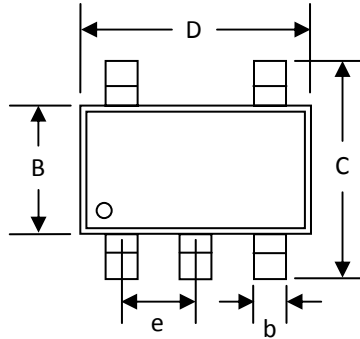
The ZT7103 can operate down to 2.5V input voltage; however the maximum load current decreases at lower input due to large IR drop on the main switch and synchronous rectifier. The slope compensation signal reduces the peak inductor current as a function of the duty cycle to prevent sub-harmonic oscillations at duty cycles greater than 50%. Conversely the current limit increases as the duty cycle decreases match other diagrams in this datasheet.

PACKAGE DIMENSION (SOT25)



Symbol	Dimensions in mm		Dimensions in Inch	
	Min	Max	Min	Max
A	1.20	1.40	0.047	0.055
A1	0.05	0.15	0.002	0.006
B	1.525	1.675	0.060	0.066
b	0.35	0.50	0.014	0.020
C	2.70	2.90	0.106	0.114
D	2.825	2.975	0.111	0.117
e	0.95 BSC		0.037 BSC	
H	0.08	0.22	0.003	0.009
L	0.35	0.55	0.014	0.022

PACKAGE DIMENSION (TSOT25)



Symbol	Dimensions in mm		Dimensions in Inch	
	Min	Max	Min	Max
A	0.913	1.100	0.036	0.043
A1	0.013	0.100	0.001	0.004
B	1.525	1.675	0.060	0.066
b	0.300	0.559	0.012	0.022
C	2.700	2.900	0.106	0.114
D	2.900	2.975	0.114	0.117
e	0.950 BSC		0.037 BSC	
H	0.135	0.200	0.005	0.009
L	0.300	0.600	0.012	0.024