2.4A,34V High Efficiency Synchronous Step-Down DC/DC Converter

Description

The ZH5324 is a synchronous step-down regulator from a high voltage input supply. Operating with an input voltage range from 8V to 30V, It achieves 2.4A continuous output current with excellent load and line regulation. The switching frequency is fixed to 125 kHz and the synchronous architecture provides for highly efficient designs. Current mode operation provides fast transient response and eases loop stabilization.

The ZH5324 requires a minimum number of readily available standard external components. Other features include cable compensation, applying 2.7V for Apple 2.4A charger and thermal shutdown.

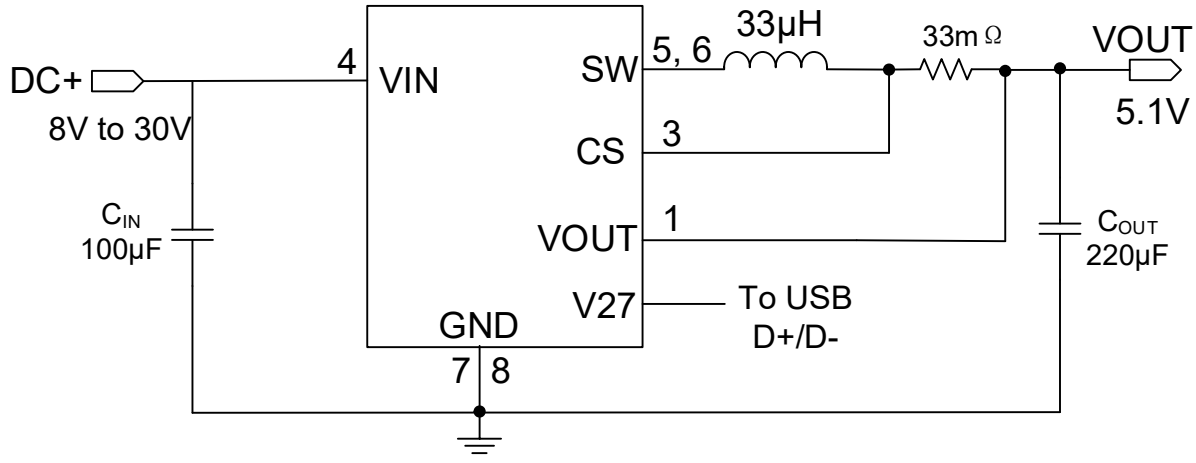
Features

- Wide VIN Range : 8V to 32V
- 2.4A Continuous Output Current
- Apple 2.7V on D+/D1
- Up to 93% Efficiency
- CC/CV Mode Control
- Built in 150mV Cable Drop Compensation
- Fixed 5.1V Output Voltages
- +/-3% Output Voltage Accuracy
- +- 6% Current Limit Accuracy.
- Fixed 125KHz switching Frequency
- Internal loop Compensation
- Internal Soft Start
- Available in SOP8 Package

Applications

- Car Charger / Adaptor
- Pre-Regulator for Linear Regulators
- Distributed Power Systems
- Battery Charger

Typical Application



Absolute Maximum Ratings (at TA = 25°C)

Characteristics	Symbol	Rating	Unit
VIN to GND		-0.3 to 34	V
SW to GND		-0.3 to VIN+0.3	V
CS, VOUT to GND		-0.3 to 8	V
Junction to Ambient Thermal Resistance		105	°C/W
Operating Junction Temperature		-40 to 150	°C
Storage Junction Temperature		-55 to 150	°C
Thermal Resistance from Junction to case	θ_{JC}	45	°C/W
Thermal Resistance from Junction to ambient	θ_{JA}	90	°C/W

Pin Function And Descriptions

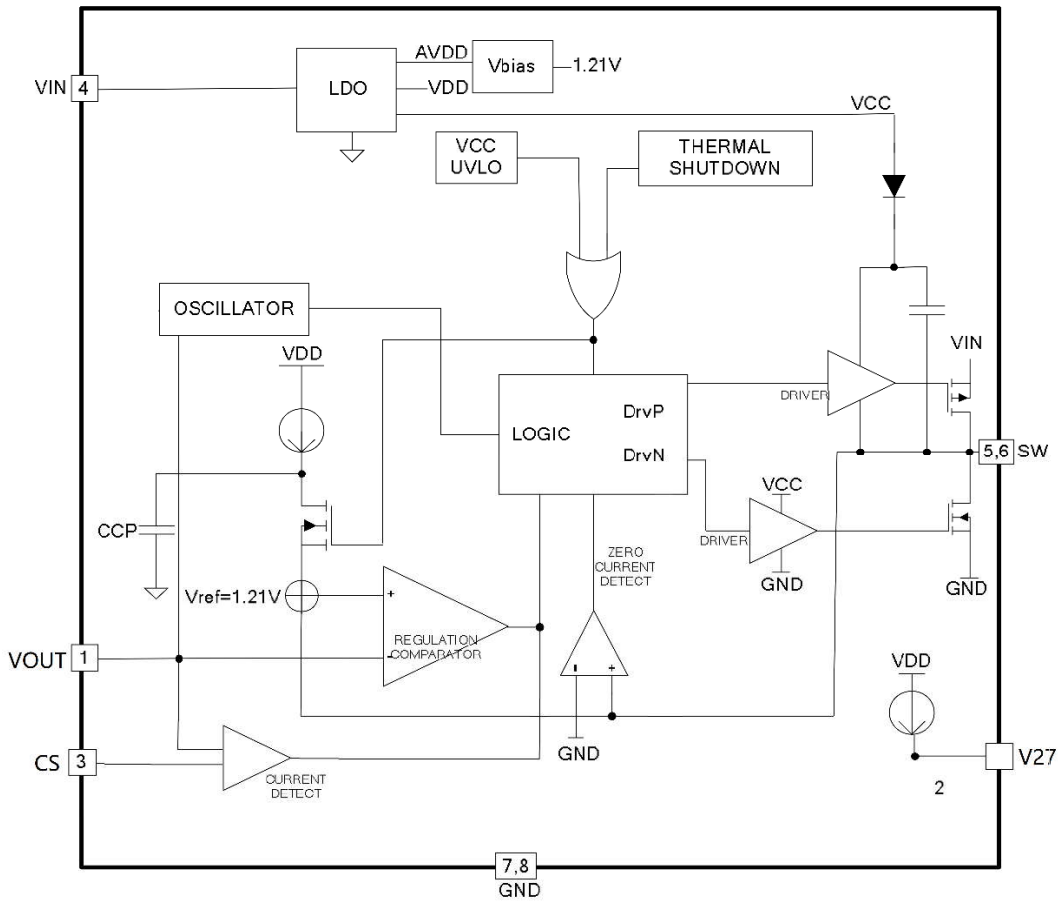
PIN	NAME	Description
1	VOUT	Output voltage and Current Sense
2	V27	2.7V for Apple 2.4A Mode
3	CS	Positive side of Current Sense
4	VIN	Power Input
5,6	SW	Switching
7,8	GND	Ground

Electrical Characteristics

TJ = 25°C. VIN = 12V, unless otherwise noted

Symbol	Characteristics	Conditions	Min	Typ	Max	Units
VIN	Input Voltage		8	-	32	V
Vovp	Input over voltage protection		32			V
I_{CCQ}	Quiescent Current	no switch	-	800	-	uA
I_{STB}	Standby Current	No Load	-	1.7	2.2	mA
V_{out}	Vout Voltage		4.95	5.10	5.25	V
V_{CS}	Current Sense	CS-VOUT	95	100	105	mV
F_{SW}	Switching Frequency			125		KHz
Tmin	Minimum On-Time		-	250	-	ns
I_{LIM}	Current Limit	internal	3.4			A
Vshort	short protect			3		V
Thiccup	Hicup Interval			500		mS
Tss	Soft start Time			2		mS
High side	RDS_{ON} Of Power MOS	Temp=25℃		65		mΩ
Low side	RDS_{ON} Of Power MOS	Temp=25℃		32		mΩ
T_{TR}	Thermal Regulation			150		°C
T_{SD}	Thermal shutdown Temp		-	165	-	°C

Block Diagram



Operation

The ZH5324 operates by a constant frequency, current mode architecture. The output voltage is set to 5.1V by an internal divider returned to the FB pin. An error amplifier compares the divided output voltage with a reference voltage of 1.21V and adjusts the peak inductor current accordingly.

Main Control Loop

During normal operation, the internal P-channel MOSFET is turned on each cycle when the oscillator sets the RS latch, and turned off when the current comparator, resets the RS latch. While the P-channel MOSFET is off, the N-channel MOSFET is turned on until either the inductor current starts to reverse, as indicated by the current reversal comparator or the beginning of the next clock cycle.

In closed-loop operation, the average current amplifier creates an average current loop that forces the average sensed current signal to be equal to the internal COMP voltage. Note that the DC gain and compensation of this average current loop is automatically adjusted to maintain an optimum current-loop response. The error amplifier adjusts the COMP voltage by comparing the internal divided-down output voltage with a 1.21V reference voltage. If the load current changes, the error amplifier adjusts the average inductor current as needed to keep the output voltage in regulation.

Low Current Operation

The discontinuous-conduction modes (DCMs) are available to control the operation of the ZH5324 at low currents. Burst Mode operation automatically switch from continuous operation to the Burst Mode operation when the load current is low

VIN Overvoltage Protections

In order to protect the devices against transient voltage spikes, the ZH5324 constantly monitors the VIN pin for an overvoltage condition. When VIN rises above 32V, the regulator suspends operation by shutting off both power MOSFETs. Once VIN drops below 31V, the regulator immediately resumes normal operation. The regulator executes its soft-start function when exiting an overvoltage condition.

Cable Drop Compensation

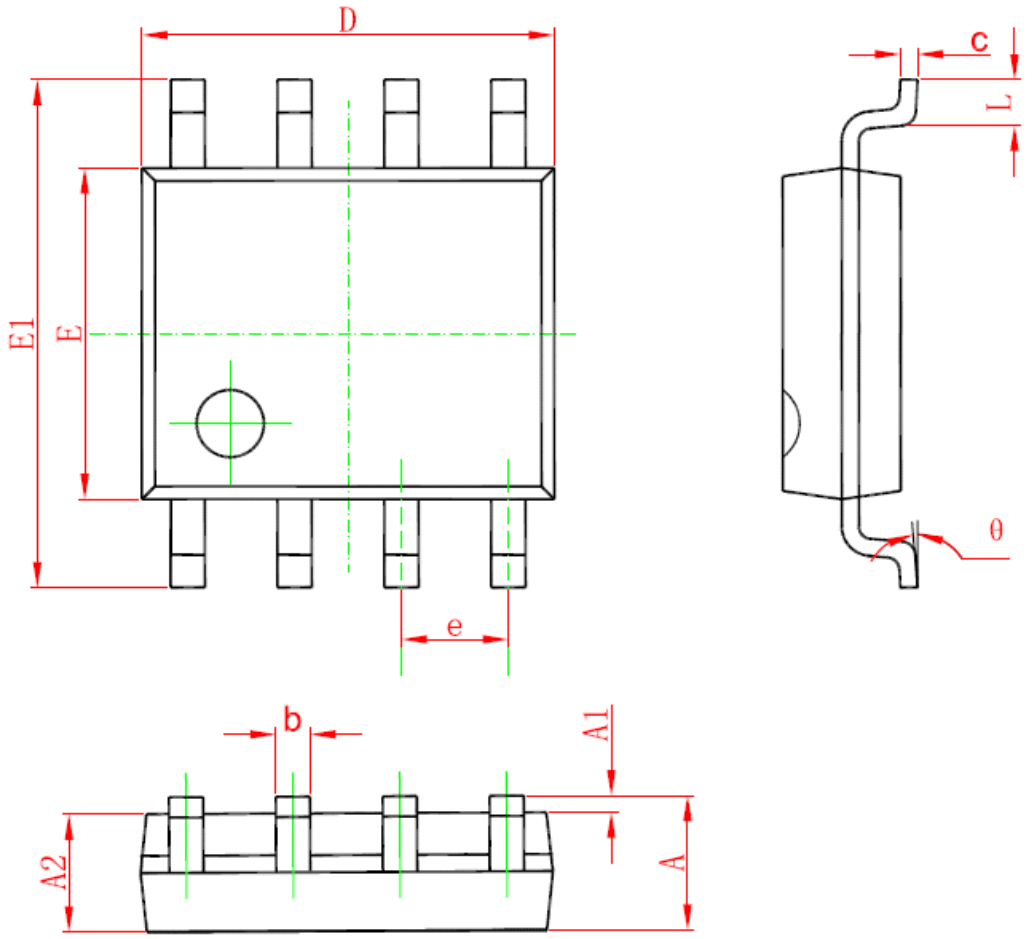
Due to the resistive of charger's output Cable, The ZH5324 built in a fix 150mV cable voltage drop compensation at full load.

Thermal Conditions

in applications where the ZH5324 is running at high ambient temperature, high VIN, and maximum output current load, the heat dissipated may exceed the maximum junction temperature of the part. If the junction temperature reaches approximately 165°C, both power switches will be turned off until the temperature drops about 30°C cooler To avoid the ZH5324 from exceeding the maximum junction temperature, the user will need to do some thermal analysis. The goal of the thermal analysis is to determine whether the power dissipated exceeds the maximum junction temperature of the part. If the application calls for a higher ambient temperature and/or higher switching frequency, care should be taken to reduce the temperature rise of the part by using a heat sink or forced air flow.

Package Description

8-Lead Standard Small Outline Package [SOP-8]



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.050	0.250	0.002	0.010
A2	1.250	1.650	0.049	0.065
b	0.310	0.510	0.012	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.150	0.185	0.203
E	3.800	4.000	0.15	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.05 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°