

150KHz, 2A PWM BUCK DC/DC CONVERTER

Description

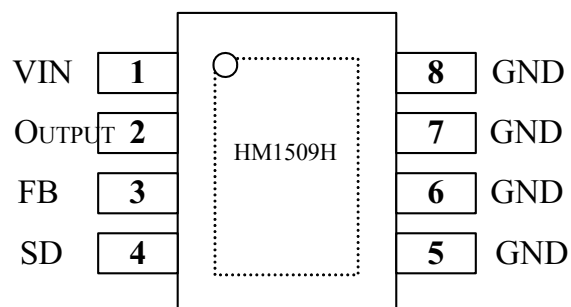
The HM1509H are monolithic IC designed for a step-down DC/DC converter, and own the ability of driving a 2A load without additional transistor. It saves board space. The external shutdown function can be controlled by logic level and then come into standby mode. The internal compensation makes feedback control having good line and load regulation without external design. Regarding protected function, thermal shutdown is to prevent over temperature operating from damage, and current limit is against over current operating of the output switch. If current limit function occurs and V_{FB} is down below 0.5V, the switching frequency will be reduced. The HM1509H operates at a switching frequency of 150KHz thus allow smaller sized filter components than what would be needed with lower frequency switching regulators. Other features include a guaranteed $\pm 4\%$ tolerance on output voltage under specified input voltage and output load conditions, and $\pm 15\%$ on the oscillator frequency. The output version included fixed 3.3V, 5V, 12V, and an adjustable type. The chips are available in a standard 8-lead SOP-8 package.

Features

- Output Voltage: 3.3V, 5V, 12V and Adjustable Output Version
- Adjustable Version Output Voltage Range, 1.23V to 18V+4%
- 150KHz +15% Fixed Switching Frequency
- Voltage Mode Non-Synchronous PWM Control
- Thermal-Shutdown and Current-Limit Protection
- ON/OFF Shutdown Control Input
- Operating Voltage can be up to 48V
- Output Load Current: 2A
- SOP-8 Packages
- Low Power Standby Mode
- Built-in Switching Transistor On Chip
- SOP-8: Available in "Green" Molding Compound (No Br, Sb)
- Lead Free Finish/ RoHS Compliant (Note 1)

Pin Assignments

TOP VIEW

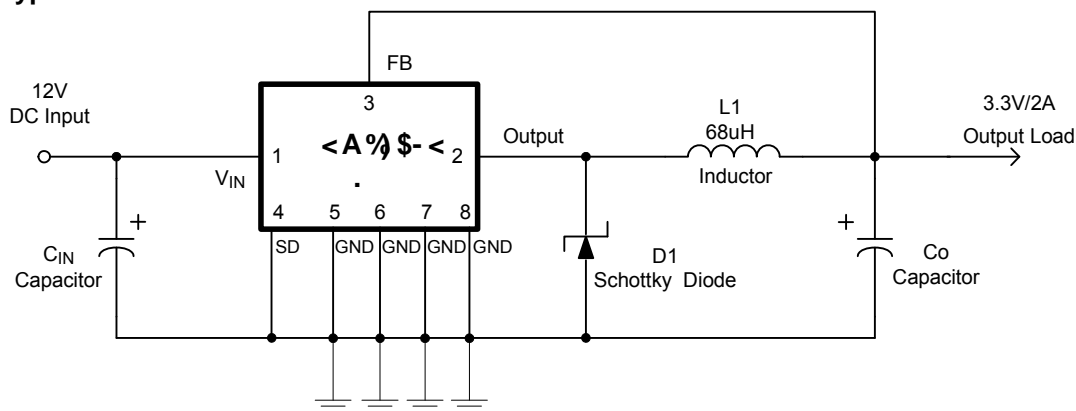


Applications

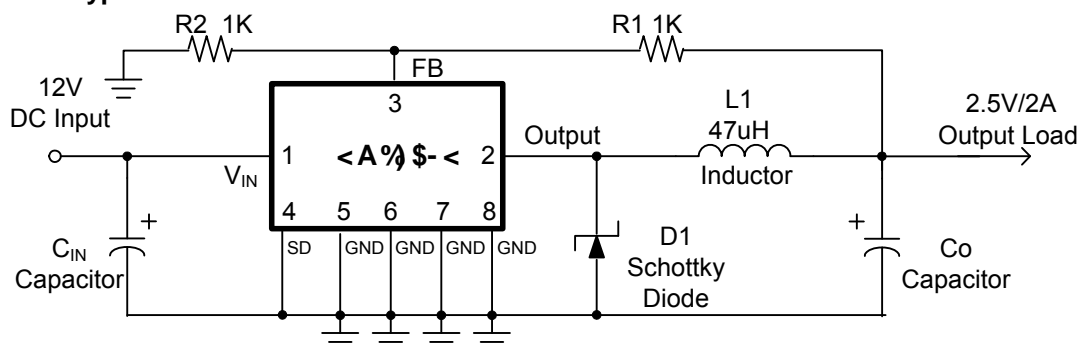
- Simple High-Efficiency Step-Down Regulator
- On-Card Switching Regulators
- Positive to Negative Converter

Typical Application Circuit

(1) Fixed Type Circuit



(2) Adjustable Type Circuit

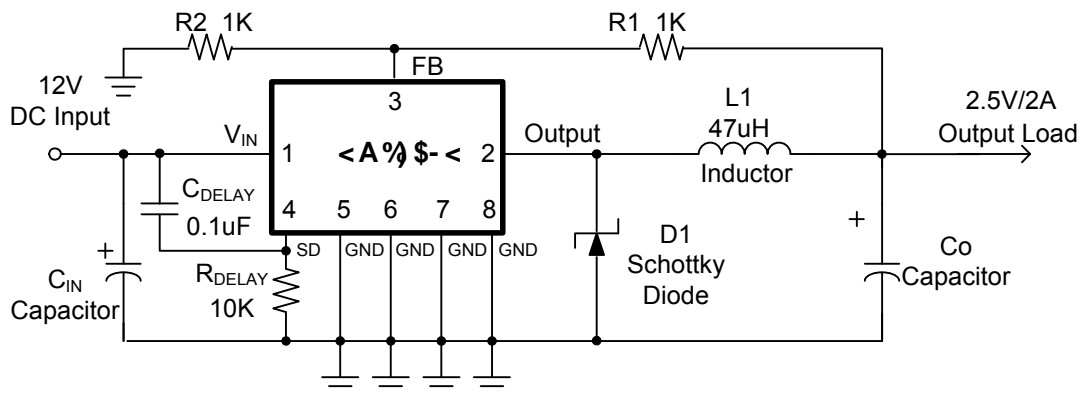


$$V_{OUT} = V_{FB} \times \left(1 + \frac{R1}{R2}\right)$$

$$V_{FB} = 1.23V$$

$$R2 = 1K \sim 3K$$

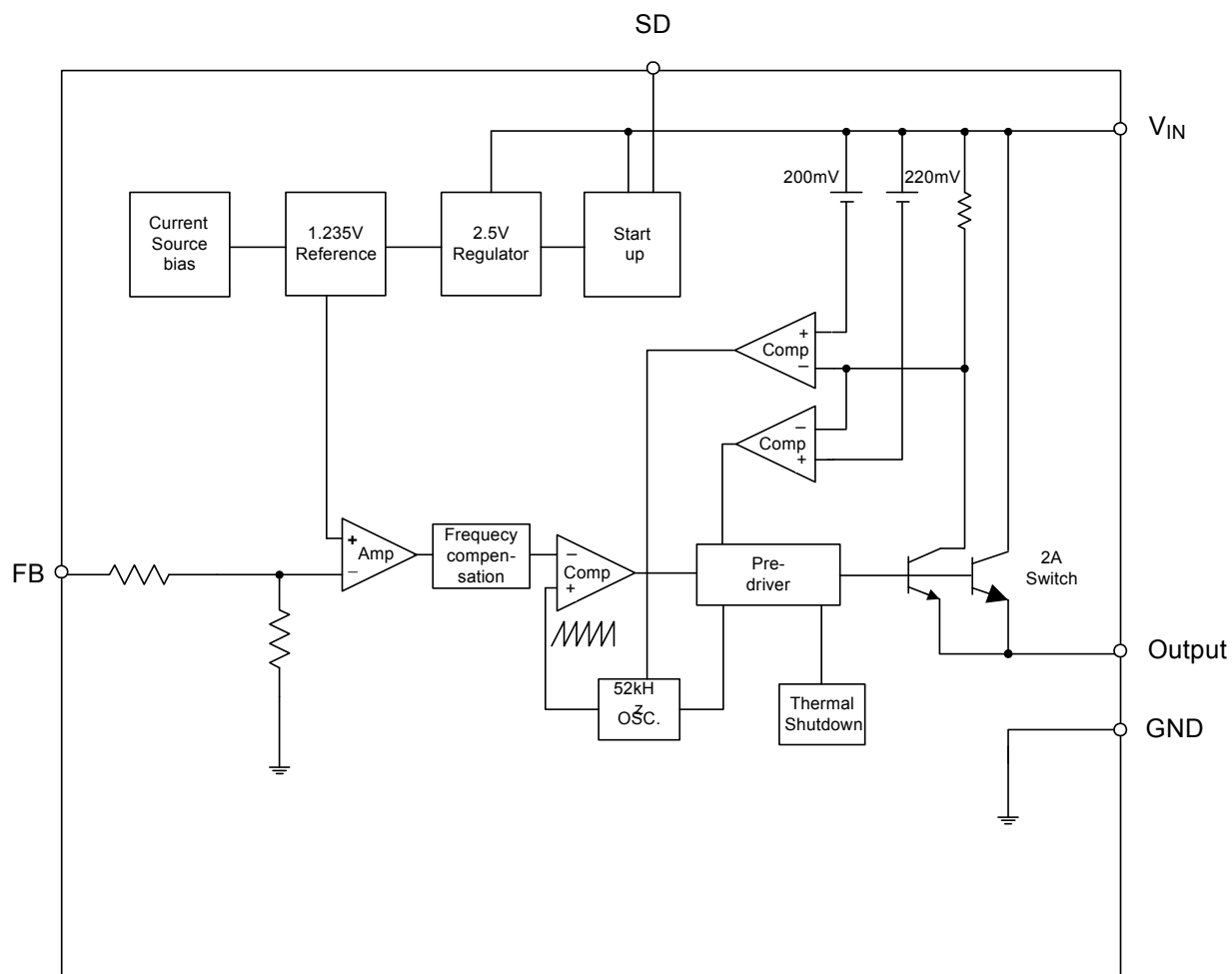
(3) Delay Start Circuit



Pin Descriptions

Pin Name	Description
V _{IN}	Operating voltage input
Output	Switching output
GND	Ground
FB	Output voltage feedback control
SD	ON/OFF Shutdown

Functional Block Diagram



Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
ESD HBM	Human Body Model ESD Protection	2	KV
ESD MM	Machine Model ESD Protection	200	V
V_{IN}	Supply Voltage	+48	V
V_{SD}	ON/OFF Pin Input Voltage	-0.3 to +18	V
V_{FB}	Feedback Pin Voltage	-0.3 to +18	V
V_{OUT}	Output Voltage to Ground	-1	V
P_D	Power Dissipation	Internally Limited	W
T_{ST}	Storage Temperature	-65 to +150	°C
T_J	Operating Junction Temperature	-40 to +125	°C

Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
I_{OUT}	Output Current	0	2	A
V_{OP}	Operating Voltage	4.5	48	V
T_A	Operating Ambient Temperature	-20	85	°C

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Electrical Characteristics

Unless otherwise specified, $V_{IN} = 12V$ for 3.3V, 5V, adjustable version and $V_{IN} = 18V$ for the 12V version. $I_{LOAD} = 0.5A$
Specifications with **boldface type** are for full operating temperature range, the other type are for $T_J = 25^\circ C$.

Symbol	Parameter		Conditions	Min	Typ.	Max	Unit
I_{FB}	Feedback Bias Current		$V_{FB} = 1.3V$ (Adjustable version only)		-10	-50 -100	nA
F_{OSC}	Oscillator Frequency			127 110	150	173 173	KHz
F_{SCP}	Oscillator Frequency of Short Circuit Protect		When current limit occurred and $V_{FB} < 0.5V$, $T_a = 25^\circ C$	10	30	50	KHz
V_{SAT}	Saturation Voltage		$I_{OUT} = 2A$ No outside circuit $V_{FB} = 0V$ force driver on		1.25	1.4 1.5	V
DC	Max. Duty Cycle (ON)		$V_{FB} = 0V$ force driver on		100		%
	Min. Duty Cycle (OFF)		$V_{FB} = 12V$ force driver off		0		
I_{CL}	Current Limit		Peak current No outside circuit $V_{FB} = 0V$ force driver on	3			A
I_L	Output = 0	Output Leakage	No outside circuit $V_{FB} = 12V$ force driver off			-200	uA
	Output = -1	Current	$V_{IN} = 22V$		-5		mA
I_Q	Quiescent Current		$V_{FB} = 12V$ force driver off		5	10	mA
I_{STBY}	Standby Quiescent Current		ON/OFF pin = 5V $V_{IN} = 22V$		70	150 200	uA
V_{IL}	ON/OFF Pin Logic Input Threshold Voltage		Low (regulator ON)	-	1.3	0.6	V
V_{IH}			High (regulator OFF)	2.0		-	
I_H	ON/OFF Pin Logic Input Current		$V_{LOGIC} = 2.5V$ (OFF)			-0.01	uA
I_L	ON/OFF Pin Input Current		$V_{LOGIC} = 0.5V$ (ON)		-0.1	-1	
θ_{JA}	Thermal Resistance		SOP-8 Junction to case		15		$^\circ C/W$
θ_{JC}	Thermal Resistance with a copper area of approximately 3 in ²		SOP-8 Junction to ambient		70		$^\circ C/W$

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Specifications with **boldface type** are for full operating temperature range, the other type are for $T_J = 25^\circ\text{C}$.

	Symbol	Parameter	Conditions	V_{Min}	Typ.	V_{Max}	Unit
HM1509H-ADJ	V_{FB}	Output Feedback	$4.5\text{V} \leq V_{\text{IN}} \leq 22\text{V}$ $0.2\text{A} \leq I_{\text{LOAD}} \leq 2\text{A}$ V_{OUT} programmed for 3V	1.193 1.18	1.23	1.267 1.28	V
	η	Efficiency	$V_{\text{IN}} = 12\text{V}$, $I_{\text{LOAD}} = 2\text{A}$	76	76		%
HM1509H-3.3V	V_{OUT}	Output Voltage	$4.75\text{V} \leq V_{\text{IN}} \leq 22\text{V}$ $0.2\text{A} \leq I_{\text{LOAD}} \leq 2\text{A}$	3.168 3.135	3.3	3.432 3.465	V
	η	Efficiency	$V_{\text{IN}} = 12\text{V}$, $I_{\text{LOAD}} = 2\text{A}$	78	78		%
HM1509H-5V	V_{OUT}	Output Voltage	$7\text{V} \leq V_{\text{IN}} \leq 22\text{V}$ $0.2\text{A} \leq I_{\text{LOAD}} \leq 2\text{A}$	4.8 4.75	5	5.2 5.25	V
	η	Efficiency	$V_{\text{IN}} = 12\text{V}$, $I_{\text{LOAD}} = 2\text{A}$	83	83		%
HM1509H-12V	V_{OUT}	Output Voltage	$15\text{V} \leq V_{\text{IN}} \leq 22\text{V}$ $0.2\text{A} \leq I_{\text{LOAD}} \leq 2\text{A}$	11.52 11.4	12	12.48 12.6	V
	η	Efficiency	$V_{\text{IN}} = 15\text{V}$, $I_{\text{LOAD}} = 2\text{A}$	90	90		%

