GM7109HV

150KHz, 60V/3A STEP DOWN VOLTAGE SWITCHING REGULATORS

Description

GM7109HV series is designed to provide all the active function for a step-down (buck) switching regulator, and drives a maximum load current as high as 3A line and load regulations. GM7109HV is available in fixed output voltages of 3.3V, 5V, and a versatile Adjustable output version.

These regulators are simple to use and require minimum number of external components. The features include internal frequency compensation and a fixed-frequency oscillator.

The GM7109HV is high-efficiency replacements for popular three-terminal linear regulators, and is requiring a smaller heat sink or even no need heat sink.

GM7109HV performs well with standard inductors from most of manufacturers, and simplifying the design of switch-mode power supplies. External shutdown is included with 80 µA (typical) standby current. The output switch has cycle-by-cycle current limiting as well as thermal shutdown for full protection under fault conditions.

GM7109HV operates at a switching frequency of 150 kHz which allowing smaller size filter components than what would be needed with lower frequency switching regulators.

GM7109HV series are available in a standard 8 lead SO package with heat sink

Features

- **Standard ESOP8 package is available**
- **3.3V, 5V, 12Vand Adjustable output versions**
- **Adjustable version output voltage range 1.23V to 57V**
- **V_{OUT} accuracy is to ±2% under specified input voltage the output load conditions**
- **Input voltage range up to 60V**
- **Requires only 4 external components with High efficiency**
- **TTL shutdown capability, low power standby mode**
- **Built-in thermal shutdown, current limit protection**
- **Uses standard inductors**
- **150 kHz fixed frequency internal oscillator**

Application

Pre-regulator for linear regulators

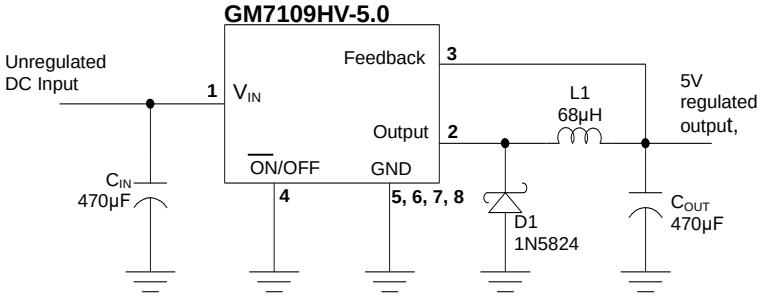
High-efficiency step-down buck regulator

On-card/board switching regulators

Positive to negative converter (buck-boost)

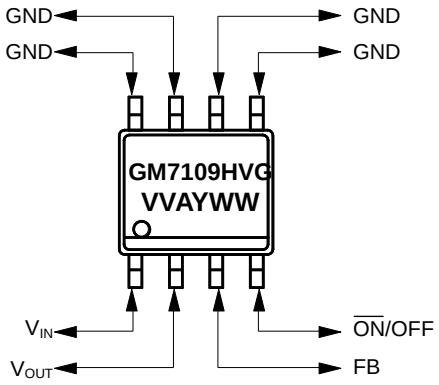
LCD Monitors

Typical Application Circuits



Marking Information and Pin Configurations – Green Products (Top View)

ESOP8



G: Green Product
VV: 33=3.3V, 50=5.0V, A=ADJ
A: Assembly/Testing factory code
Y: Year
WW: Week

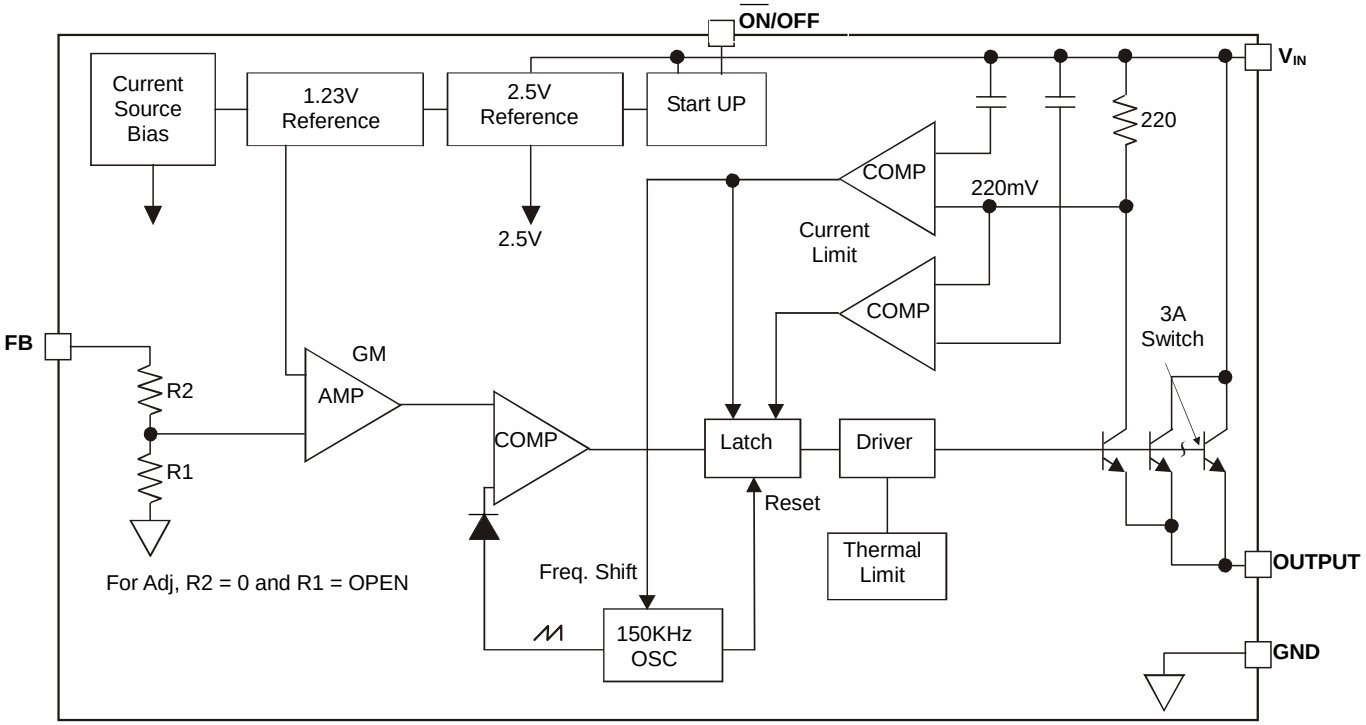
Ordering Information – Green Products

Ordering Number	Output Voltage	Package	Shipping
GM7109HV-APS8RG	Adj	ESOP8	2500 Units / Reel
GM7109HV-3.3PS8RG	3.3	ESOP8	2500 Units / Reel
GM7109HV-5.0PS8RG	5.0	ESOP8	2500 Units / Reel
GM7109HV-12PS8RG	12	ESOP8	2500 Units / Reel

Absolute Maximum Ratings (Note 1)

Rating	Value	Unit
Maximum Supply Voltage	63	V
ON/OFF Pin Input Voltage	-0.3 to V_{IN} + 0.3	V
Feedback Pin Voltage	-0.3 to 25 + 0.3	V
Output Voltage to Ground (Steady State)	-1.0	V
Power Dissipation	Internally Limited	-
Thermal Resistance – Junction to Ambient (θ_{JA}) ** 2 square inch of FR-4, double sided, 1oz. minimum copper weight, is recommended	36	℃/W
Storage Temperature Range	- 65 to 150	℃
Maximum Junction Temperature	+ 150	℃
Operating Temperature Range	- 40 to 125	℃
Minimum EDS Rating (Note 2)	2	kV
Lead Temperature (Soldering, 10 sec)	+ 260	℃

Block Diagram



Electrical Characteristics: GM7109HV-ADJ

(Specifications with standard type face are for T = 25°C, and those with bold face type apply over full Operating Temperature rage)

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Output Voltage	$8V \le V_{IN} \le 60V$, $0.2A \le I_{LOAD} \le 3A$, $V_{OUT} = 5V$	V_{OUT}	1.193 **1.180**	1.230	1.267 **1.280**	V
Efficiency	V_{IN} =12V, I_{LOAD}=3.0A, V_{OUT} = 5V	η		79		%

Electrical Characteristics: GM7109HV-3.3

(Specifications with standard type face are for T = 25°C, and those with bold face type apply over full Operating Temperature rage)

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Output Voltage	$5.5V \le V_{IN} \le 60V$, $0.2A \le I_{LOAD} \le 3A$	V_{OUT}	3.168 **3.135**	3.300	3.432 **3.465**	V
Efficiency	V_{IN} =12V, I_{LOAD}=3.0A	η		77		%

Electrical Characteristics: GM7109HV-5.0

(Specifications with standard type face are for T = 25°C, and those with bold face type apply over full Operating Temperature rage)

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Output Voltage	$8V \le V_{IN} \le 60V$, $0.2A \le I_{LOAD} \le 3A$	V_{OUT}	4.800 **4.7500**	5.000	5.200 **5.250**	V
Efficiency	V_{IN} =12V, I_{LOAD}=3.0A	η		79		%

Electrical Characteristics: GM7109HV-12

(Specifications with standard type face are for T = 25°C, and those with bold face type apply over full Operating Temperature rage)

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Output Voltage	$15V \le V_{IN} \le 60V$, $0.5A \le I_{LOAD} \le 3A$	V_{OUT}	11.52 **11.40**	12.00	12.48 **12.60**	V
Efficiency	V_{IN} =15V, I_{LOAD}=3.0A	η		83		%

Electrical Characteristics: All Output Voltage Versions

(Specifications with standard type face are for T_J = 25°C, and those with bold face type apply over full Operating Temperature rage. Unless otherwise specified, V_{IN} = 12V for 3.3V, 5V, and Adjustable version, and V_{IN} = 24V for 12V version, I_{LOAD} = 500mA)

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Feedback Bias Current	V_{FB}=1.3V (Adjustable Version Only)	I_b	-50	-10		nA
			-100			
Line Regulation	8V ≤ V_{IN} ≤ 60V, I_{LOAD} = 0.2A	LNR		0.3		%
Load Regulation	V_{IN} = 12V, 0.2A ≤ I_{LOAD} ≤ 3A	LDR		0.3		%
Oscillator Frequency		f_o	133	150	168	kHz
			120		**180**	
Oscillator Frequency of Short Circuit Protection (SCP)	V_{OUT} < 40% from Nominal, I_{OUT} = CL			50		kHz
Saturation Voltage	I_{OUT} = 3A, No outside circuit, V_{FB}=0V	V_{SAT}	-	1.35	1.5	V
					1.7	
Max Duty Cycle (ON)	V_{FB}=0V, force driver ON	DC_{MAX}	100		**-**	%
Min Duty Cycle (OFF)	V_{FB}=12V, force driver OFF, (V_{FB} =15V for 12V version)	DC_{MIN}			0	%
Current Limit	Peak Current, No outside circuit, V_{FB}=0V	I_{CL}	3.8	5.3	7.0	A
Output Leakage Current	Output=0V, No outside circuit, V_{FB}=12V	I_L	-300	-50		μA
	Output = -1.0V, No outside circuit, V_{FB}=12V		-30	-3		mA
Quiescent Current	V_{FB}=12V, force driver OFF,	I_Q	-	5	8	mA
Standby Quiescent Current	ON/OFF Pin = 5V (OFF), V_{IN} = 60V	I_{STBY}	-	30	220	μA
ON/OFF Pin Logic Input Level	Low (ON)	V_{IH}	-	1.3	0.6	V
	High (OFF)	V_{IL}	2.0	1.3	-	
SD Pin Input Current	V_{LOGIC} = 2.5V (OFF)	I_H		5	15	μA
	V_{LOGIC} = 0.5V (ON)	I_L		0.02	5	μA
Thermal Shutdown Temperature		T_J		160		℃

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics.

Note 2: The human body model is a 100pF capacitor discharged through a 1.5KΩresistor into each pin.

Test Circuit and Layout Guidelines

Careful layout is important with any switching regulators. Rapidly switching currents associated with wiring inductance generate voltage transients which can cause problems. To minimize inductance and ground loops, the lengths of the leads indicated by heavy lines in Figure 1&2 below should be kept as short as possible. Single point grounding (as indicated or ground plane construction should be used for best results. When using the Adjustable version, place the programming resistors as close as possible to GM7109HV, to keep the sensitive feedback wiring short.

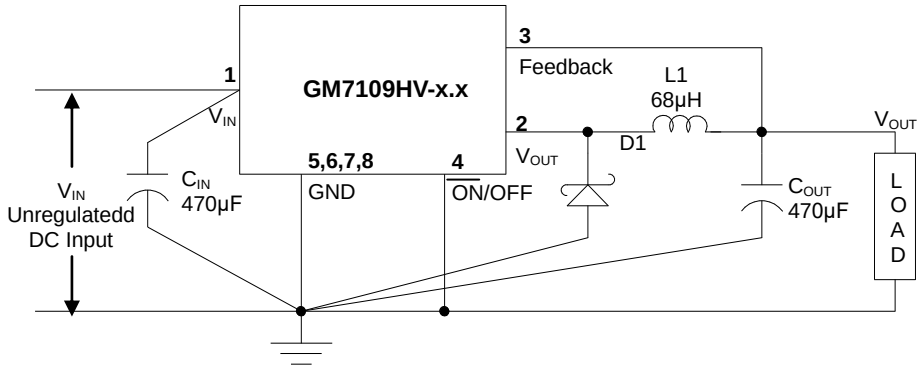


Figure 1 Fixed Ouput Votlage Versions

C_{IN} = 470μF, Aluminum Electrolytic
C_{OUT} = 470μF, 25V, Aluminum Electrolytic
D1 = Schottky
L1 = 68μH

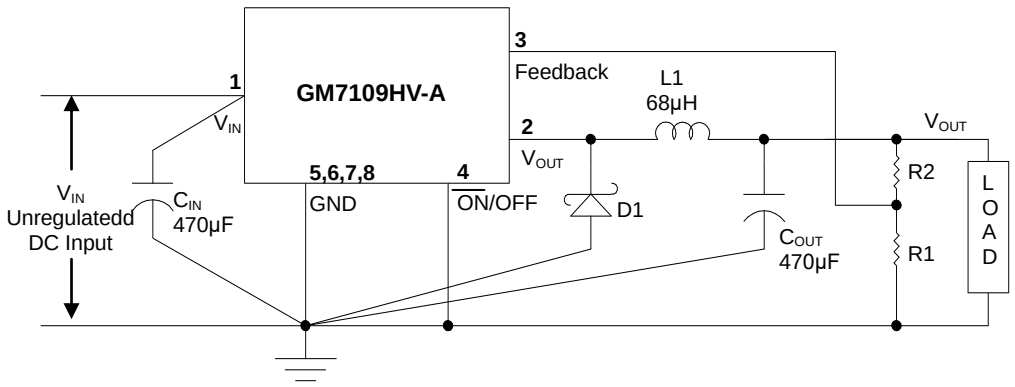


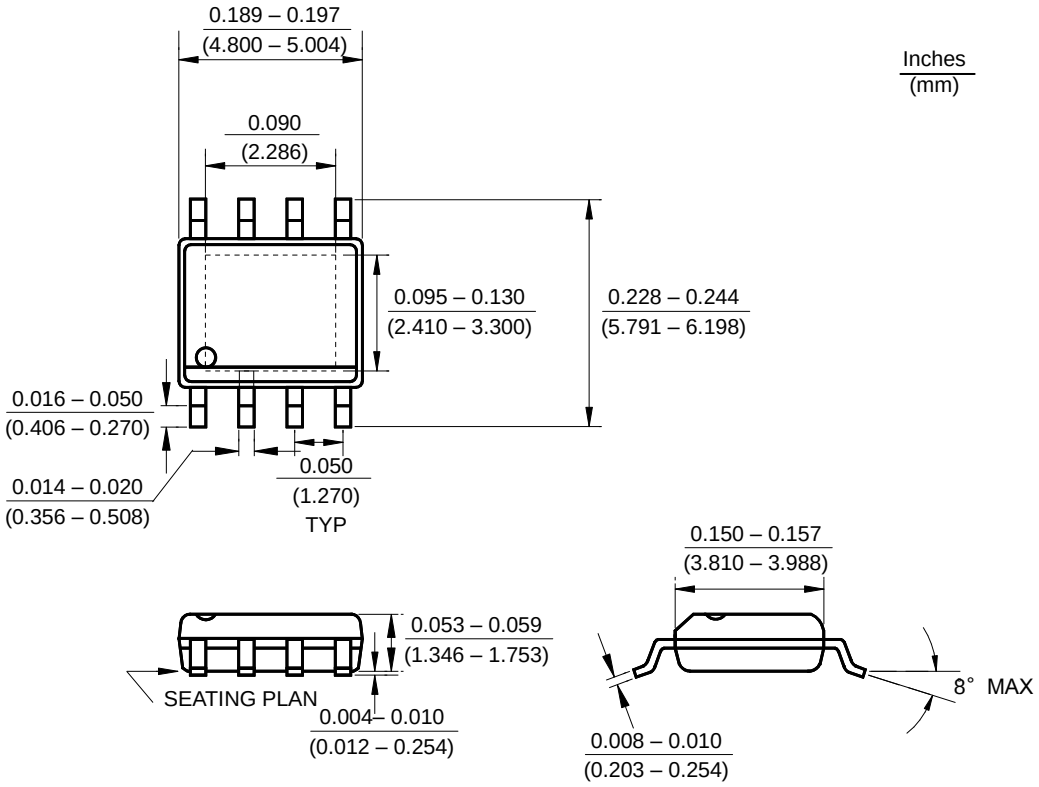
Figure 2 Adjustable Ouput Votlage Versions

C_{IN} = 470μF, Aluminum Electrolytic
C_{OUT} = 470μF, 25V, Aluminum Electrolytic
D1 = Schottky
L1 = 68μH

$V_{OUT} = V_{REF} (1 + R2/R1)$

Suggested R1 = 500Ω to 1.5K

Package Outline Dimensions – ESOP8



Ordering Number

GM	7109HV	A	PS8	R	G
APM Gamma	Circuit Type	Output Voltage	Package Type	Shipping Type	
		A: Adj 3.3 = 3.3V 5.0 =5.0V	PS8: ESOP8	R: Taping & Reel T: Tube	G:Green Products

Note:

Green products:

- Lead-free (RoHS compliant)
- Halogen free(Br or Cl does not exceed 900ppm by weight in homogeneous material and total of Br and Cl does not exceed 1500ppm by weight)