

Description

GM7130HV 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. GM7130HV is available in fixed output voltages of 3.3V, 5V, 12V 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 GM7130HV is high-efficiency replacements for popular three-terminal linear regulators, and is requiring a smaller heat sink or even no need heat sink.

GM7130HV performs well with standard inductors from most of manufacturers, and simplifying the design of switch-mode power supplies. External shutdown is included with 80 μ A (typical) standby current. The output switch has cycle-by-cycle current limiting as well as thermal shutdown for full protection under fault conditions.

GM7130HV operates at a switching frequency of 52 kHz which allowing smaller size filter components than what would be needed with lower frequency switching regulators.

GM7130HV series are available in a standard 5-lead TO-220, TO220B and TO263 packages.

Features

- ◆ 3.3V, 5V, 12V and Adjustable output versions
- ◆ Adjustable version output voltage range 1.23V to 57V
- ◆ V_{OUT} accuracy is up to $\pm 2\%$ 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
- ◆ 52 kHz fixed frequency internal oscillator

Application

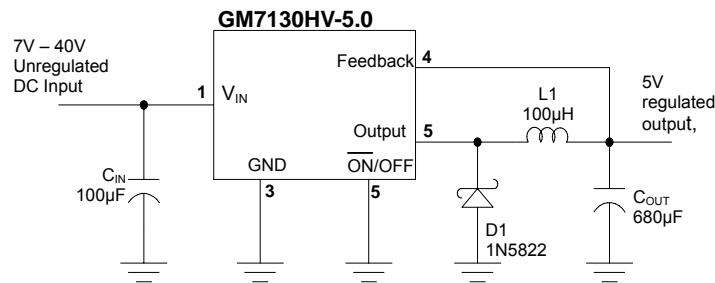
Pre-regulator for linear regulators

On-card/board switching regulators

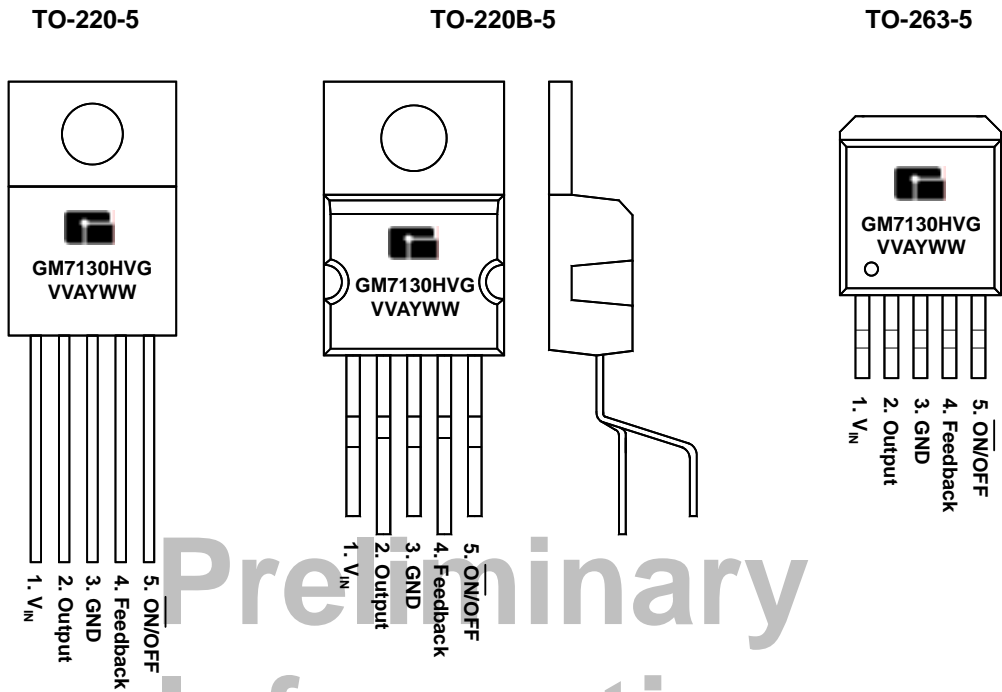
High-efficiency step-down buck regulator

Positive to negative converter (buck-boost)

Typical Application Circuits



Marking Information and Pin Configurations (Top View)



G: Green Product
 VV: Voltage suffix (15 = 1.5V, 50 = 5.0V...A = Adj)
 A: Assembly / Test site code
 Y: Year
 WW: Week

Ordering Information

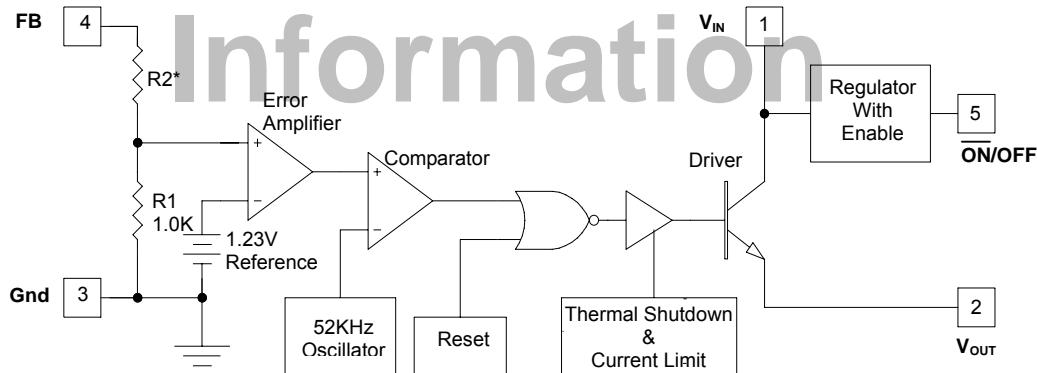
Ordering Number	Output Voltage	Package	Shipping
GM7130HV-ATA5TG	Adj	TO-263-5	50 Units / Tube
GM7130HV-ATA5RG		TO-263-5	800 Units / Reel
GM7130HV-ATB5TG		TO-220-5	50 Units / Tube
GM7130HV-ATB5BTG		TO-220-5B	50 Units / Tube
GM7130HV-3.3TA5TG	3.3	TO-263-5	50 Units / Tube
GM7130HV-3.3A5RG		TO-263-5	800 Units / Reel
GM7130HV-3.3B5TG		TO-220-5	50 Units / Tube
GM7130HV-3.3B5BTG		TO-220-5B	50 Units / Tube
GM7130HV-5.0TA5TG	5.0	TO-263-5	50 Units / Tube
GM7130HV-5.0A5RG		TO-263-5	800 Units / Reel
GM7130HV-5.0B5TG		TO-220-5	50 Units / Tube
GM7130HV-12B5BTG		TO-220-5B	50 Units / Tube
GM7130HV-12TA5TG	12	TO-263-5	50 Units / Tube
GM7130HV-12A5RG		TO-263-5	800 Units / Reel
GM7130HV-12B5TG		TO-220-5	50 Units / Tube
GM7130HV-12B5BTG		TO-220-5B	50 Units / Tube

Preliminary
Information

Absolute Maximum Ratings (Note 1)

Rating	Value	Unit
Maximum Supply Voltage	63	V
$\overline{\text{ON/OFF}}$ Pin Input Voltage	$-0.3 + V_{\text{IN}} + 0.3$	V
Feedback Pin Voltage	$-0.3 + V_{\text{IN}} + 0.3$	V
Output Voltage to Ground (Steady State)	-1.0	V
Power Dissipation	Internally Limited	-
Storage Temperature Range	- 65 to 150	°C
Maximum Junction Temperature	+ 150	°C
Operating Temperature Range	- 40 to 125	
Minimum EDS Rating (Note 2)	2	kV
Lead Temperature (Soldering, 10 sec)	+ 260	°C

Block Diagram



$V_{\text{OUT}} = 3.3\text{V}$, $R2 = 1.7\text{K}$
 $V_{\text{OUT}} = 5.0\text{V}$, $R2 = 3.1\text{K}$
 $V_{\text{OUT}} = 12\text{V}$, $R2 = 8.84\text{K}$
 $V_{\text{OUT}} = \text{ADJ}$, $R1 = \text{OPEN}$, $R2 = 0\Omega$

Electrical Characteristics: GM7130HV-ADJ

(Specifications with standard type face are for $T_j = 25^\circ\text{C}$, and those with **bold face** type apply over full Operating Temperature range)

Parameter	Condition (Note 3)	Symbol	Min	Typ	Max	Unit
Feedback Voltage	$V_{IN} = 12V, I_{LOAD} = 0.5A, V_{OUT} = 5V,$ Circuit of Fig 2.	V_{OUT}	1.217	1.230	1.243	V
	$8.0V \leq V_{IN} \leq 60V, 0.5A \leq I_{LOAD} \leq 3A,$ $V_{OUT} = 5V,$ Circuit of Fig 2.		1.193		1.267	
			1.180		1.280	
Efficiency	$V_{IN} = 12V, I_{LOAD} = 3.0A, V_{OUT} = 5V$	η		77		%

Electrical Characteristics: GM7130HV-3.3

(Specifications with standard type face are for $T = 25^\circ\text{C}$, and those with bold face type apply over full Operating Temperature range)

Parameter	Condition (Note 3)	Symbol	Min	Typ	Max	Unit
Output Voltage	$V_{IN} = 12V, I_{LOAD} = 0.5A,$ Circuit of Fig 2.	V_{OUT}	3.234	3.300	3.366	V
	$6V \leq V_{IN} \leq 60V, 0.5A \leq I_{LOAD} \leq 3A,$ Circuit of Fig 2		3.168		3.432	
			3.135		3.465	
Efficiency	$V_{IN} = 12V, I_{LOAD} = 3.0A$	η		75		%

Electrical Characteristics: GM7130HV-5.0

(Specifications with standard type face are for $T = 25^\circ\text{C}$, and those with bold face type apply over full Operating Temperature range)

Parameter	Condition (Note 3)	Symbol	Min	Typ	Max	Unit
Output Voltage	$V_{IN} = 12V, I_{LOAD} = 0.5A,$ Circuit of Fig 2.	V_{OUT}	4.900	5.000	5.100	V
	$8V \leq V_{IN} \leq 60V, 0.5A \leq I_{LOAD} \leq 3A,$ Circuit of Fig 2.		4.800		5.200	
			4.750		5.250	
Efficiency	$V_{IN} = 12V, I_{LOAD} = 3.0A$	η		77		%

Electrical Characteristics: GM7130HV-12

(Specifications with standard type face are for $T = 25^\circ\text{C}$, and those with bold face type apply over full Operating Temperature range)

Parameter	Condition (Note 3)	Symbol	Min	Typ	Max	Unit
Output Voltage	$V_{IN} = 25V, I_{LOAD} = 0.5A,$ Circuit of Fig 2.	V_{OUT}	11.76	12.00	12.24	V
	$15V \leq V_{IN} \leq 60V, 0.5A \leq I_{LOAD} \leq 3A,$ Circuit of Fig 2.		11.52		12.48	
			11.40		12.60	
Efficiency	$V_{IN} = 15V, I_{LOAD} = 3.0A$	η		88		%

Electrical Characteristics: All Output Voltage Versions

(Specifications with standard type face are for $T_J = 25^\circ\text{C}$, and those with bold face type apply over full Operating Temperature range. Unless otherwise specified, $V_{IN} = 12\text{V}$ for 3.3V, 5.0V and Adj version, $V_{IN} = 25\text{V}$ for 12V version, $I_{LOAD} = 500\text{mA}$)

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Feedback Bias Current	$V_{OUT} = 5\text{V}$ (Adjustable Version Only)	I_b	-	50	100	nA
					500	
Oscillator Frequency	(Note 8)	f_o	47	52	58	kHz
			42		63	
Saturation Voltage	$I_{OUT} = 3\text{A}$ (Notes 4)	V_{SAT}	-	1.4	1.8 2.0	V
Max Duty Cycle (ON)	(Note 5)	DC	93	98	-	%
Current Limit	Peak Current (Notes 4, 8)	I_{CL}	4.2	5.8	6.9	A
			3.5		7.5	
Output Leakage Current	Output = 0V (Notes 6, 7)	I_L	-	7.5	2	mA
	Output = -1V (Notes 6, 7)				30	
Quiescent Current	(Note 6)	I_Q	-	5	10	mA
Standby Quiescent Current	$\overline{\text{ON/OFF}} = 5\text{V}$ (OFF)	I_{STBY}	-	50	200	μA
$\overline{\text{ON/OFF}}$ Pin Logic Input Level	Low (ON)	V_{IH}	-	1.2	1.0 0.8	V
	High (OFF)	V_{IL}	2.2 2.4	1.4	-	
$\overline{\text{ON/OFF}}$ Pin Input Current	$V_{LOGIC} = 2.5\text{V}$ (OFF)	I_H	-	12	30	μA
	$V_{LOGIC} = 0.5\text{V}$ (ON)	I_L	-	0	10	

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: All limits guaranteed at room temperature (standard type face) and at temperature extremes (bold type face).

Note 3: External components such as the catch diode, inductor, input and output capacitors can affect switching regulator system performance. When the GM7130HV is used as shown in the Figure 2 test circuit, system performance will be as shown in system parameters section of Electrical characteristics.

Note 4: Output pin sourcing current. No diode, inductor or capacitor connected to output.

Note 5: Feedback pin removed from output and connected to 0V.

Note 6: Feedback pin removed from output and connected to +12V for the Adjustable, 3.3V, and 5V, versions, and +25V for the 12V and 15V versions, to force the output transistor OFF.

Note 7: $V_{IN} = 40\text{V}$ (60V for high voltage version).

Note 8: The oscillator frequency reduces to approximately 11 kHz in the event of an output short or an overload which causes the regulated output voltage to drop approximately 40% from the nominal output voltage. This self protections feature lowers the average power dissipation of the IC by lowering the minimum duty cycle from 5% down to approximately

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 GM2576, to keep the sensitive feedback wiring short.

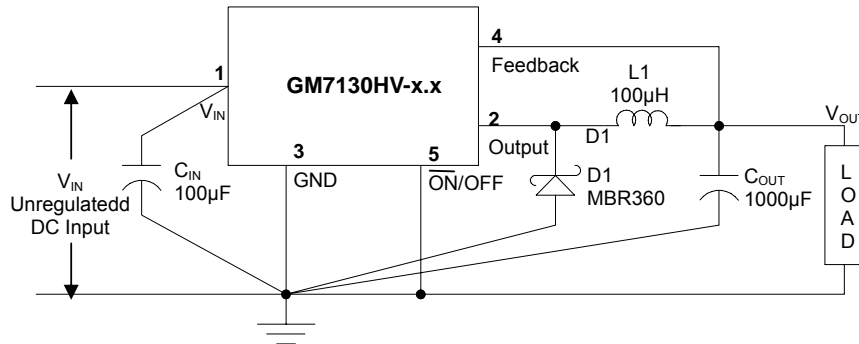


Figure 1 Fixed Output Voltage Versions

$C_{IN} = 100\mu\text{F}$, 75V, Aluminum Electrolytic
 $C_{OUT} = 1000\mu\text{F}$, 25V, Aluminum Electrolytic
 D1 = Schottky, MBR360
 $L1 = 100\mu\text{H}$

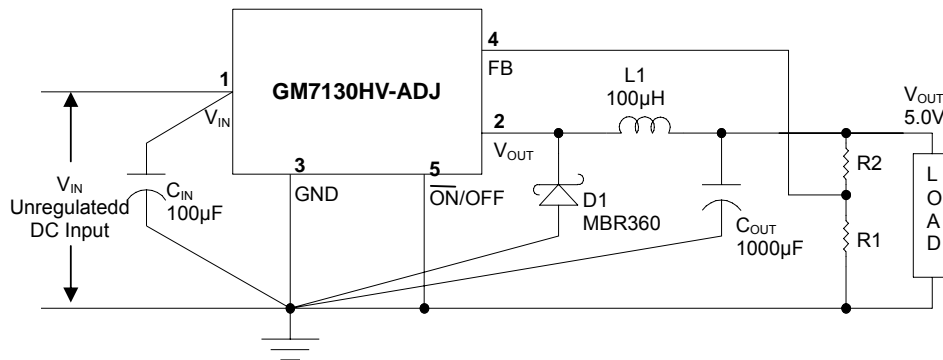


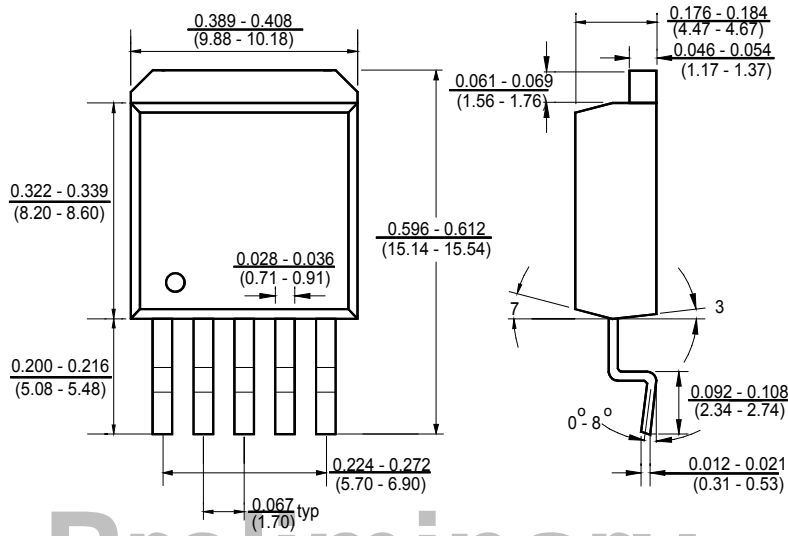
Figure 2 Adjustable Output Voltage Versions

$C_{IN} = 100\mu\text{F}$, 75V, Aluminum Electrolytic
 $C_{OUT} = 1000\mu\text{F}$, 25V, Aluminum Electrolytic
 D1 = Schottky
 $L1 = 100\mu\text{H}$

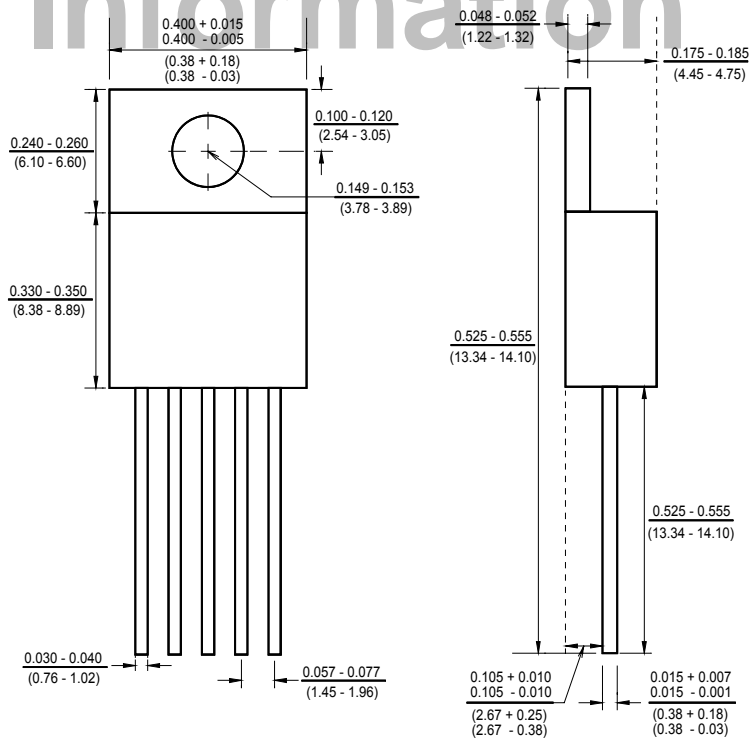
$$V_{OUT} = V_{REF} (1 + R2/R1)$$

where $V_{REF} = 1.23\text{V}$ and $R1$ is between 1K to 5K

Package Outline Dimensions – TO-263-5



Package Outline Dimensions – TO-220-5



Ordering Number

GM 7130HV A TA5 R G

APM
Gamma
Micro

Circuit Type	Output Voltage	Package Type	Shipping Type	Blank: Pb-free G: Green
	A: Adj 3.3 = 3.3V 5.0 = 5.0V 12 = 12.0V	TA5: TO263-5 TB5: TO-220-5 TB5B: TO-220B-5	R:Taping & Reel T:Tube	

Preliminary Information