GR1507 3A 150KHz 40V Buck DC to DC Converter

1. General Description

1.1 Description

The GR1507 is a 150 KHz fixed frequency PWM buck (step-down) DC/DC converter, capable of driving a 3A load with high efficiency, low ripple and excellent line and load regulation. Requiring a minimum number of external components, the regulator is simple to use and include internal frequency compensation and a fixed-frequency oscillator.

The PWM control circuit is able to adjust the duty ratio linearly from 0 to 100%. An enable function, an over current protection function is built inside. When second current limit function happens, the operation frequency will be reduced from 150KHz to 50KHz. An internal compensation block is built in to minimize external component count.

1.2 Features

- 3.3-V, 5-V, 12-V, and adjustable output versions
- Wide 4.5V to 40V Input Voltage Range
- Output Adjustable from 1.23V to 37V
- Fixed 150KHz Switching Frequency
- Internal Optimize Power Transistor
- High efficiency
- Excellent line and load regulation
- TTL shutdown capability
- ON/OFF pin with hysteresis function
- Built in thermal shutdown function
- Built in second current limit function

1.3 Device Information

PART NUMBER	PACKAGE
GR1507	TO252

2. Connection Diagrams and Pin Description

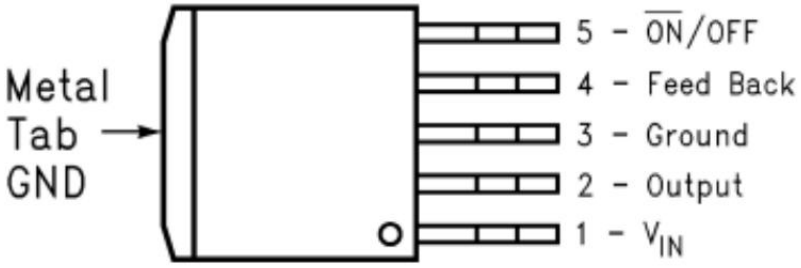


Figure 2.1: Top view

PIN No. TO252	NAME	I/O	FUNCTION
1	V_{IN}	I	This is the positive input supply for the IC switching regulator. A suitable input bypass capacitor must be present at this pin to minimize voltage transients and to supply the switching currents required by the regulator.
2	Output	O	Internal switch. The voltage at this pin switches between approximately (+VIN - VSAT) and approximately -0.5 v, with a duty cycle of VOUT / VIN. To minimize coupling to sensitive circuitry, the PCB copper area connected to this pin must be kept to a minimum.
3	Ground	-	Circuit ground
4	Feedback	I	Senses the regulated output voltage to complete the feedback loop.
5	$\overline{ON}$/OFF	I	Allows the switching regulator circuit to be shut down using logic signals thus dropping the total input supply current to approximately 80 uA.Pulling this pin below a threshold voltage of approximately 1.3 V turns the regulator on, and pulling this pin above 1.3 V (up to a maximum of 25 V) shuts the regulator down. If this shutdown feature is not required.the ON/OFF pin can be wired to the ground pin or it can be left open. in either case, the regulator will be in the ON condition.

3. Functional Block Diagram

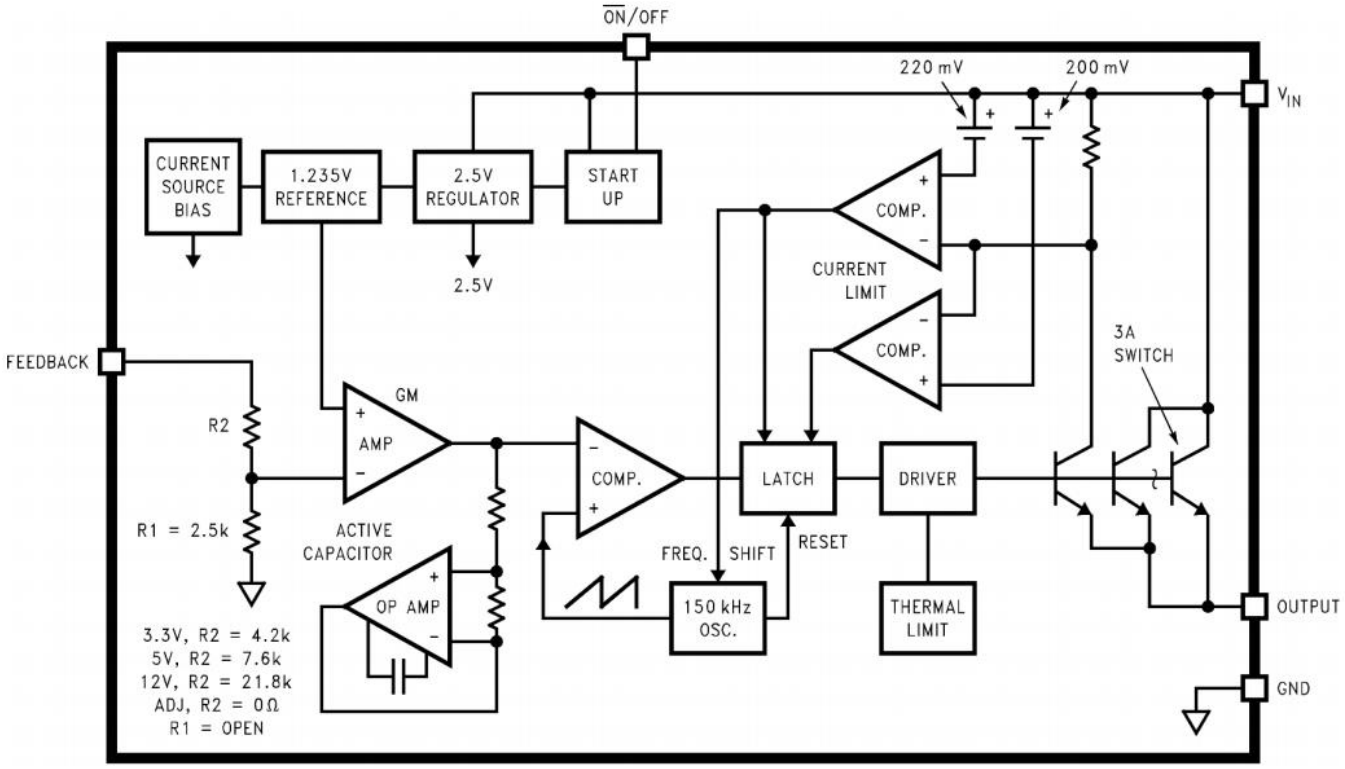


Figure 3.1：GR1507 Functional Block Diagram

4. Specifications

4.1 Absolute Maximum Ratings

(Ta=25℃,unless otherwise specified)

Parameter	MIN	MAX	Unit
Maximum supply voltage (VIN)		45	V
Feedback pin voltage	-0.3	25	V
Output voltage to ground, steady-state		-1	V
Power dissipation	Internally limited		
Maximum junction temperature		125	℃
Storage temperature, Tstg	-65	150	℃

Absolute maximum ratings are those values beyond which the device could be permanently damaged,These are stress ratings only,which do not imply functional operation of the device at these or any other conditions beyond those indicated under normal operating conditions.

4.2 Recommended Operating Conditions

Parameter	MIN	MAX	Unit
Supply voltage	4.5	40	V
Operating Temperature	-40	85	℃

4.3 Electrical Characteristics-3.3V Version

(T_a=25℃,unless otherwise specified)

Symbol	Parameter	Test Condition	MIN	TYP	MAX	Unit
V_{OUT}	Output voltage	4.75 V≤ VN ≤ 40 V, 0.2 A ≤ ILOAD ≤ 3 A	3.168	3.3	3.432	V
η	Efficiency	VIN = 12 V, ILOAD = 3 A		73%		

4.4 Electrical Characteristics-5V Version

(T_a=25℃,unless otherwise specified)

Symbol	Parameter	Test Condition	MIN	TYP	MAX	Unit
V_{OUT}	Output voltage	7 V≤ VN ≤ 40 V, 0.2 A ≤ ILOAD ≤ 3 A	4.8	5	5.2	V
η	Efficiency	VIN = 12 V, ILOAD = 3 A		80%		

4.5 Electrical Characteristics-12V Version

(T_a=25℃,unless otherwise specified)

Symbol	Parameter	Test Condition	MIN	TYP	MAX	Unit
V_{OUT}	Output voltage	15V≤ VN ≤ 40 V, 0.2 A ≤ ILOAD ≤ 3 A	11.52	12	12.48	V
η	Efficiency	VIN = 25 V, ILOAD = 3 A		90%		

4.6 Electrical Characteristics-Adjustable Voltage Version

(T_a=25℃,unless otherwise specified)

Symbol	Parameter	Test Condition	MIN	TYP	MAX	Unit
V_{FB}	Feedback voltage	4.5V≤ VN ≤ 40 V, 0.2 A ≤ ILOAD ≤ 3 A		1.23		
		Vout programmed for 3V	1.193		1.267	V
η	Efficiency	VIN = 12 V, ILOAD = 3 A		73%		

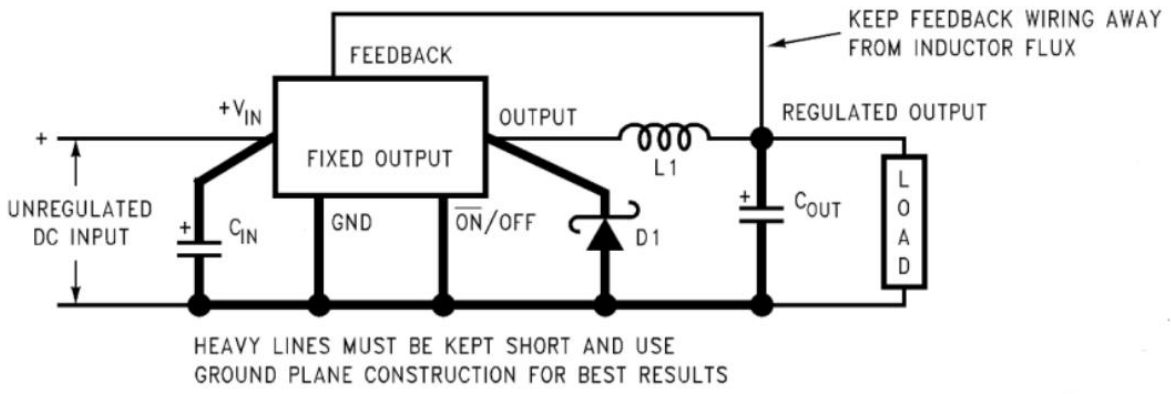
4.7 Electrical Characteristics – All Output Voltage Versions

Specifications are for TJ= 25°C, ILOAD = 500 mA, VIN = 12 V for the 3.3-V, 5-V, and adjustable version, and VIN = 24 V for the 12-V version (unless otherwise noted)

Symbol	Parameter	Test Condition	MIN	TYP	MAX	Unit
Ib	Feedback bias current	Adjustable version only, VFB=1.3V		10	50	nA
fo	Oscillator frequency		127	150	183	khz
Vsat	Saturation voltage	Iout=3A		1.5		V
DC	Max duty cycle(ON)			100%		
	Min duty cycle(OFF)			0%		
I_{CL}	Current limit	Peak current	3.6	4.5	6.9	A
I_L	Output leakage current	Output=0v,Vin=40v			50	uA
		Output=-1v		2	30	mA
I_Q	Operating quiescent current			5	10	mA
I_{STBY}	Current standby quiescent	$\overline{ON}$/OFF pin=5v(OFF)		80	200	uA
$\overline{SHUTDOWN}$/SOFT-START CONTROL						
VIH	$\overline{ON}$/OFF pin logic input threshold voltage	*Low (regulator ON)*		1		V
VIL		*High (regulator OFF)*		1.3		V
IH	$\overline{ON}$/OFF pin input current	*VLogic = 2.5 V (regulator OFF)*		10	15	uA
IL		*VLogic = 0.5 V (regulator ON)*		10		uA

5. Applications information

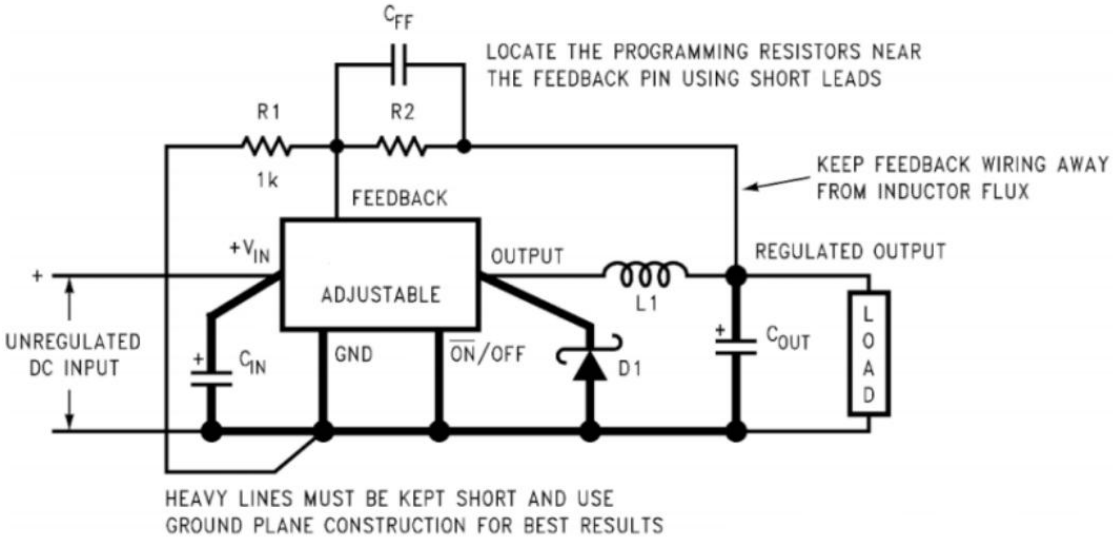
5.1 Fixed Output Series Buck Regulator



CIN — 470-μF, 50-V; COUT — 220-μF, 25-V ; D1 — 5-A, 40-V ; L1 — 68 μH;

Figure 5.1. Fixed Output Voltage Version

5.2 Adjustable Output Series Buck Regulator



VOUT = VREF (1 + R2/R1) ;

CIN — 470-μF, 50-V; COUT — 220-μF, 35-V; D1 — 5-A, 40-V; L1 — 68 μH; R1 — 1kΩ, 1%;

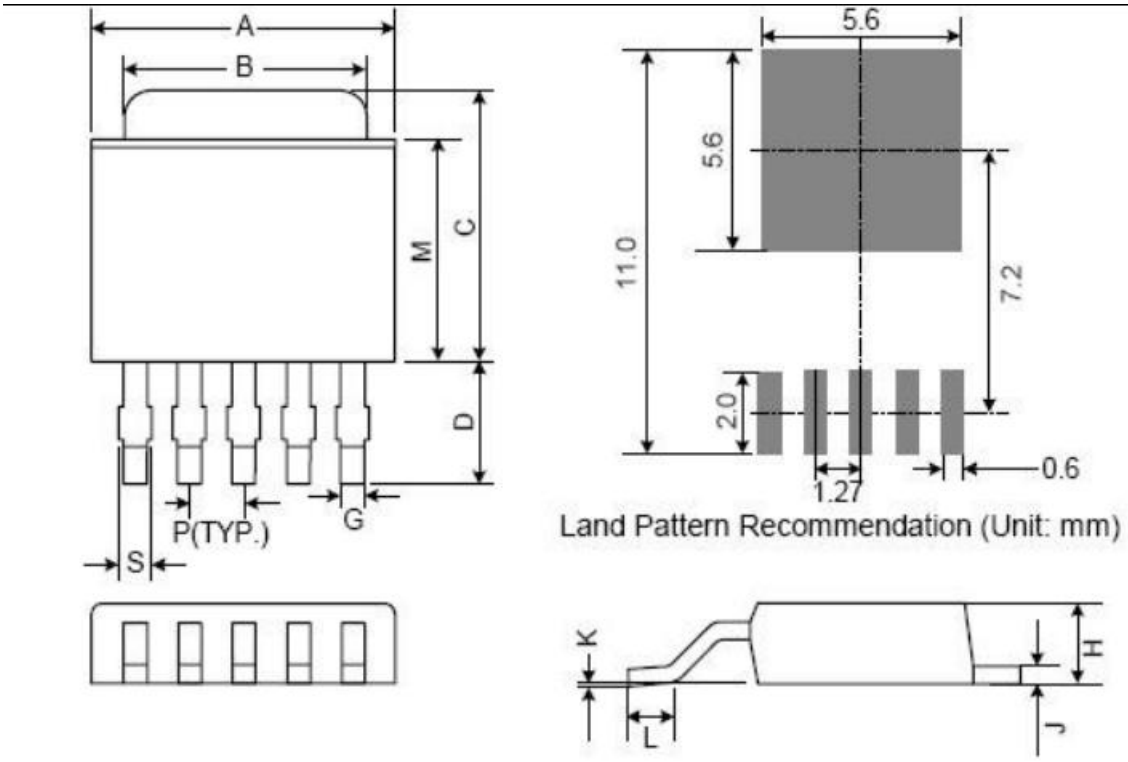
Figure 5.2. Adjustable Output Voltage Version

6. Ordering Information

Orderable Device	Package Type	Pins	Packing	Package Qty
GR1507-3.3EW05ATHQ	TO252	5	Tube	80
GR1507-5.0EW05ATHQ	TO252	5	Tube	80
GR1507-12EW05ATHQ	TO252	5	Tube	80
GR1507-ADJEW05ATHQ	TO252	5	Tube	80
GR1507-3.3EW05ARBE	TO252	5	Tape & Reel	2500
GR1507-5.0EW05ARBE	TO252	5	Tape & Reel	2500
GR1507-12EW05ARBE	TO252	5	Tape & Reel	2500
GR1507-ADJEW05ARBE	TO252	5	Tape & Reel	2500

7. Package Information

7.1 TO252



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	6.35	6.60	6.85	0.250	0.260	0.270
B	5.20	5.35	5.50	0.205	0.211	0.217
C	6.80	7.00	7.30	0.268	0.276	0.287
D	2.40	2.80	3.20	0.094	0.110	0.126
P	1.27 REF.			0.050 REF.		
S	0.50	0.65	0.80	0.020	0.026	0.031
G	0.40	0.50	0.63	0.016	0.020	0.025
H	2.20	2.30	2.40	0.087	0.091	0.094
J	0.45	0.52	0.58	0.018	0.020	0.023
K	0.00	0.08	0.15	0.000	0.003	0.006
L	0.90	1.20	1.63	0.035	0.047	0.064
M	5.40	5.80	6.20	0.213	0.228	0.244