Voltage Regulator Test Results

Test performed by: Chris Bajorek, RCG: SoaringDude
Test date: 04/05/2012 Last edits: 4/6/2012 9pm Minor typo edits.

Product tested: Voltron 6A 5.4v

Manufacturer's specs

Regulator type: Linear
Input voltage: 6.0-8.4v
Output voltage: 5.4v (fixed)
Load, continuous: 6A
Load, surge: 10A
Weight: 14g (mfgr says 13g)
Dimensions: 18 x 42 x 11mm
Website: http://www.velocity-rc.com/cgi-bin/vrc/prod/manager.cgi?action=show&pid=26&cid=3&p=1
Regulator IC used: n/a
Minimum load current: n/a

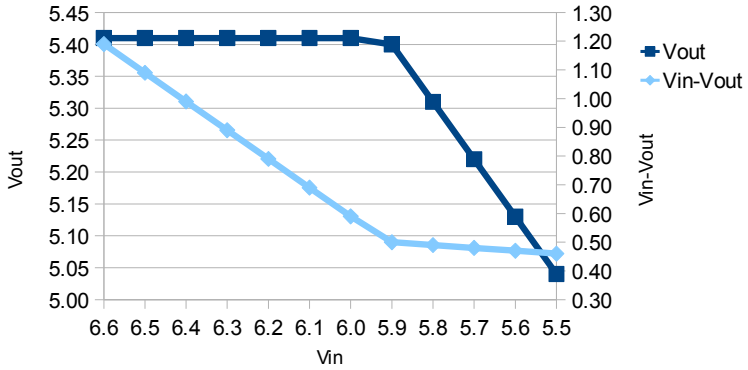
Product submitted by: PDX Slope Pilot (RC Groups)

Picture 1: Voltage regulator size compared to a quarter and a 1450mAh LiFe 2S Hyperion battery pack.

Also see a pic of the backside of the regulator at the end of this report.

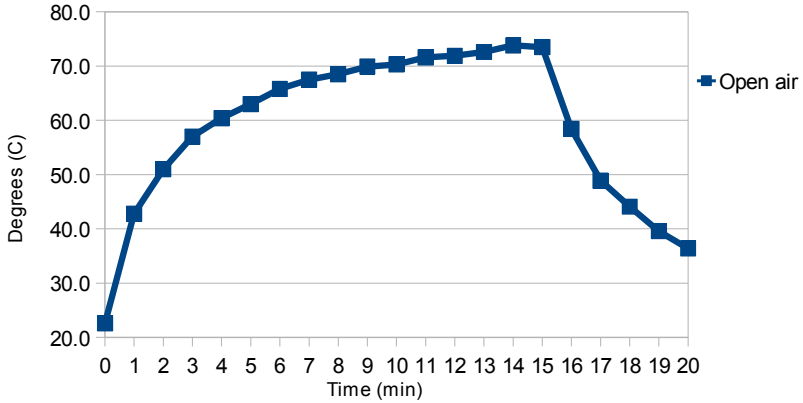
Conditions set for all tests: Voltage regulator Vout =5.4v (fixed)

Graph 1: Low Voltage Dropout Characteristics, 1.1A load



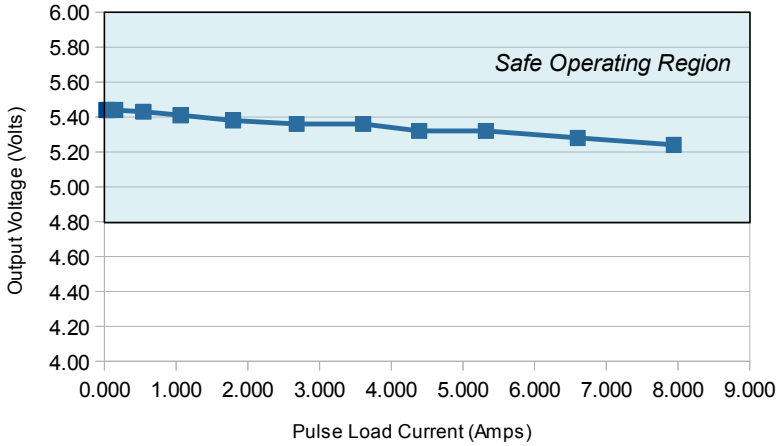
DROPOUT PERFORMANCE: Good. As Vin drops below 5.9v the regulator falls out of regulation while still delivering continuous voltage and current. Below dropout Vout was always ~0.46v less than Vin.

Graph 2: Thermal Performance, 2.2A load

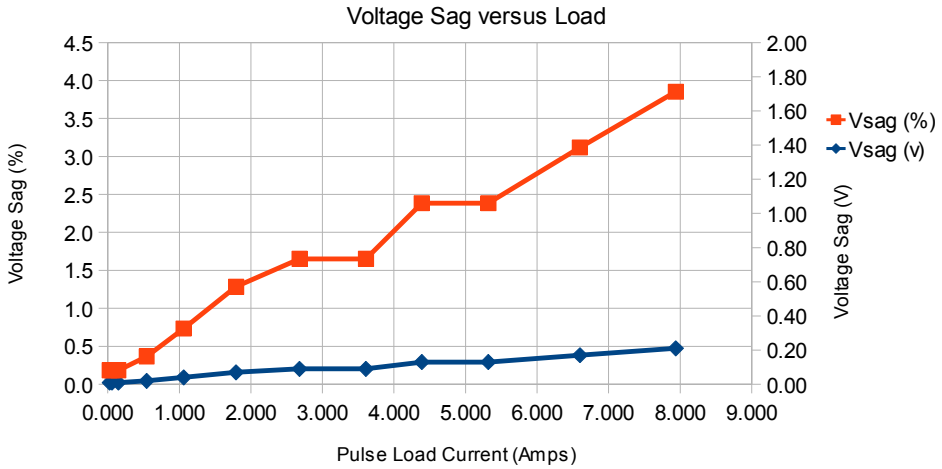


THERMAL PERFORMANCE: Pass. At a constant load the temperature took ~12 minutes to reach near maximum and substantially cooled with no load in about 5 minutes. This regulator can run with a hot external temperature similar to the Greentronic RegSlim. Because of that it is suggested you keep this regulator away from foam or plastic in your fuselage. When we know what type of integrated circuit the regulator uses we can calculate how close to the thermal limit the device is coming. We do not have that info for this unit.

Graph 3: Voltage Regulator Pulse Load Performance



Graph 4: Pulse Load Test



PROS: Low cost, extremely good high current regulation performance.

CONS: **(a)** The back side (see Pic 2 at end of report) of the regulator has surface mount components that are only protected by a thin layer of shrink wrap plastic—it is recommended you tape a thin layer of foam on this side. **(b)** This regulator uses more active components (i.e. ICs, transistors) than other linear regulators tested so far. We feel the excellent performance more than justifies the added complexity.

EFFICIENCY: at a nominal input voltage of 6.6v and an average current of 0.6A the regulator's efficiency is 83% (Input Pwr/ Output Pwr). Most linear regs should run in this general ballpark.

PULSE LOAD PERFORMANCE: (for comparative pulse load test graphs see the separate Pulse test Compilation Report on RC Info Share) See test details below. This critical test generates short very high current demands such as those found in a typical 6-servo competition sailplane in high-G maneuvers The ideal regulator in our application could handle such loads with minimal voltage sag. The Voltron 6A unit performed extremely well to pulsed high current loads and has an incredibly flat regulation characteristic, the best so far of all we have tested.

RF RADIATION (SWITCHING UNITS ONLY): Not performed for this unit (Voltron is a linear regulator).

CONCLUSION: If you are looking for a no-compromise regulator for your serious competition sailplane that can handle the highest current servo loads without voltage sag, this is the product to use. Best in class!

Table 1: Quiescent Current Test

Vin	Iin- mA	Rload- ohms	Vout	Iout- mA	Pvr- mW		Conditions	Comments
7.0	20.4	none	5.45		142.80		Red led ON	Calculate VR power consumption with no load (aka “ground pin current”)
6.6	18.1	none	5.44		119.46		Red led ON	

Table 2: High limit input voltage load test—short duration

Vin	Iin- A	Rload- ohms	Vout	Iout- A	Pvr- W	Eff.- %	Conditions	Comments

7.0	0.046	220.0	5.45	0.05	0.05	85%	30 seconds at each load. Regulator red led ON for all loads.	Pvr is power dissipated by VR unit
7.0	0.081	94.0	5.44	0.09	0.08	86%		
7.0	0.151	36.6	5.44	0.16	0.19	82%		
7.0	0.567	10.0	5.43	0.57	0.87	78%		
7.0	1.109	5.1	5.41	1.12	1.70	78%		
7.0		3.0	5.38	1.83	-9.85	#DIV/0!		

Table 3: Nominal input voltage load test—short duration

Vin	Iin- A	Rload- ohms	Vout	Iout- A	Pvr- W	Eff.- %	Conditions	Comments
6.6	0.047	220.0	5.45	0.05	0.04	88%	30 seconds at each load. Regulator red led ON for all loads.	Pvr is power dissipated by VR unit
6.6	0.082	94.0	5.44	0.09	0.05	90%		
6.6	0.152	36.6	5.44	0.16	0.13	87%		
6.6	0.567	10.0	5.43	0.57	0.65	83%		
6.6	1.108	5.1	5.41	1.12	1.25	83%		
6.6		3.0	5.38	1.82	-9.79	#DIV/0!		

Table 4: Low Vin dropout test

Vin	Iin- A	Rload- ohms	Vout	Iout- A	Vin-Vout		Conditions	Comments
6.6	1.109	5.1	5.41	1.12	1.19			Keep in mind wiring provided by the VR vendor is also dropping some voltage.
6.5	1.109	“	5.41	1.12	1.09			
6.4	1.108	“	5.41	1.11	0.99			
6.3	1.108	“	5.41	1.11	0.89			
6.2	1.107	“	5.41	1.11	0.79			
6.1	1.107	“	5.41	1.11	0.69			
6.0	1.107	“	5.41	1.11	0.59			
5.9	1.103	“	5.40	1.11	0.50			
5.8	1.084	“	5.31	1.09	0.49			
5.7	1.064	“	5.22	1.07	0.48			
5.6	1.046	“	5.13	1.05	0.47			
5.5	1.028	“	5.04	1.03	0.46			
5.4	1.008	“	4.95	1.01	0.45			
5.3	0.989	“	4.85	0.99	0.45			

Table 5: Thermal test: Open air

Time (min)	Vin	Iin- A	Rload- ohms	Vout	Iout- A	Temp- C		Conditions	Comments
0	6.8		3.0	5.45		22.6			VR on table facing up. Using non-contacting infrared thermal probe pointed at hottest area of regulator that could be found.
1	“		“	5.38		42.8			
2	“		“	5.38		51.0			
3	“		“	5.38		57.0			
4	“		“	5.38		60.4			
5	“		“	5.38		63.0			
6	“		“	5.37		65.8			
7	“		“	5.37		67.5			

8	“		“	5.37		68.5			
9	“		“	5.37		69.9			
10	“		“	5.36		70.3			
11	“		“	5.36		71.6			
12	“		“	5.36		71.9			
13	“		“	5.36		72.6			
14	“		“	5.36		73.8			
15	“		“	5.36		73.5			Load disconnected here
16	“		“	5.44		58.4			
17	“		“	5.44		48.9			
18	“		“	5.44		44.1			
19	“		“	5.44		39.6			
20	“		“	5.44		36.4			

Table 6: Pulse Load test

Vin	Vout (no load)	Vout (load)	Rload-ohms	Iload- A (calc)	Vsag (v)	Vsag (%)	Conditions	Comments- Include description of waveform anomalies seen during pulsed loads	Vin-Vout(load)
6.66	5.45	5.44	220	0.025	0.01	0.2	Load pulses 350mS long @ 1 pulse per second	Regulator load ratings: Continuous=6A, Peak=10A	1.22
6.66	5.45	5.44	94	0.058	0.01	0.2			1.22
6.65	5.45	5.44	37	0.149	0.01	0.2			1.21
6.60	5.45	5.43	10	0.543	0.02	0.4			1.17
6.53	5.45	5.41	5.1	1.061	0.04	0.7			1.12
6.45	5.45	5.38	3.0	1.793	0.07	1.3			1.07
6.32	5.45	5.36	2.0	2.680	0.09	1.7			0.96
6.24	5.45	5.36	1.485	3.609	0.09	1.7			0.88
6.08	5.45	5.32	1.212	4.389	0.13	2.4			0.76
6.00	5.45	5.32	1.0	5.320	0.13	2.4			0.68
5.92	5.45	5.28	0.80	6.600	0.17	3.1			0.64
5.76	5.45	5.24	0.66	7.939	0.21	3.9			0.52

Pulse Load test notes:

1. A range of loads were “pulsed” on and off to simulate real world hi-g servo loads using an actual LiFe 2S battery pack.
2. Target currents range from 30mA to as high as 9A depending on where the regulator's Vout was set (lower Vout's yield lower load currents).
3. Vin = input v to regulator, Vout=output v from regulator.
4. Vin drops as load current increases due to the 1450mAh LiFe battery internal resistance and regulator input wiring.
5. Vin in the results table above is measured during a brief period when each load is manually switched on.
6. Vout measurements are taken from captured digital storage oscilloscope traces during load pulsing.

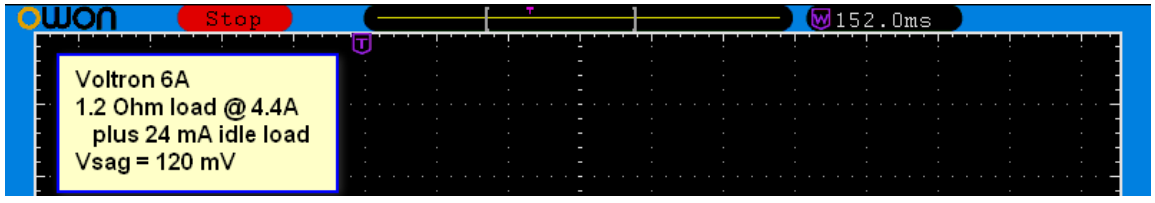
Pulse Load Digital Storage Scope Screenshots:

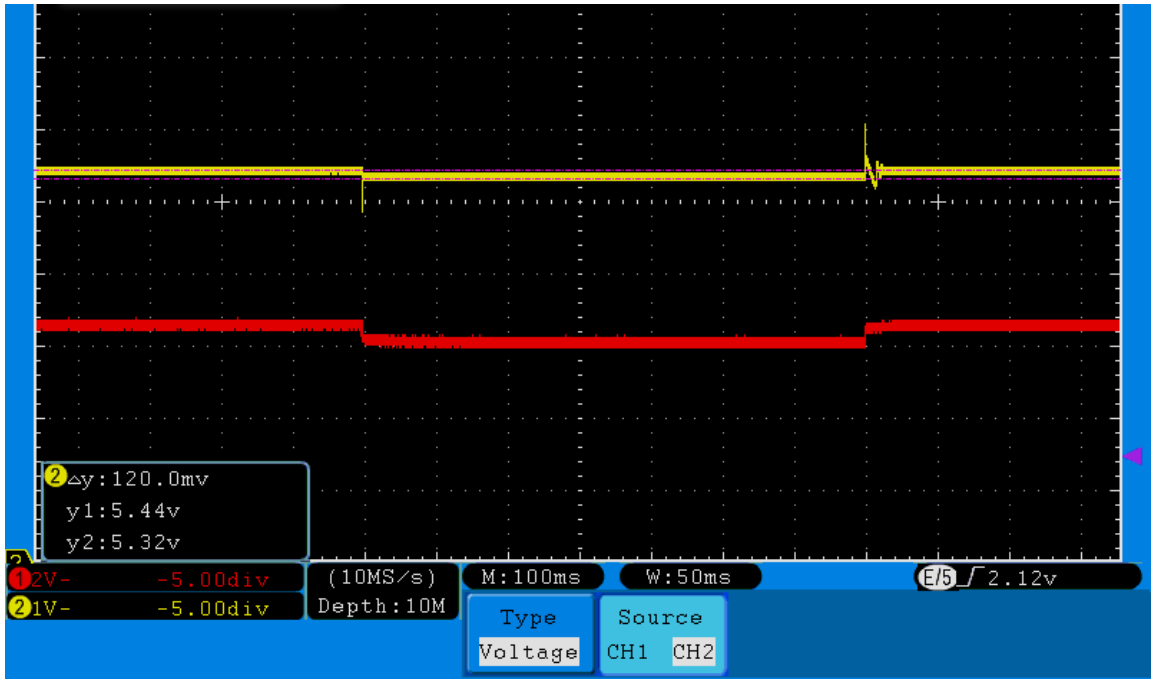
Notes:

Yellow trace = Vout from regulator

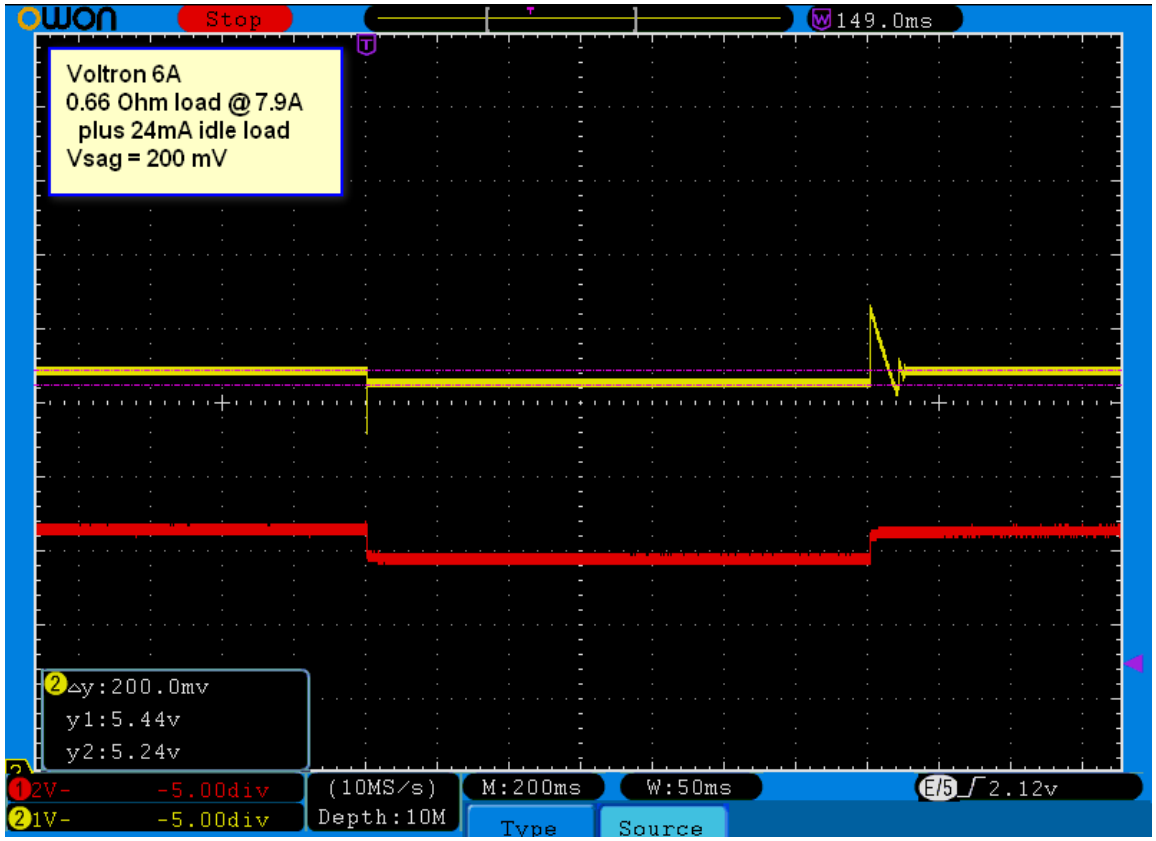
Red trace = LiFe pack input voltage

Screen 1:





Screen 2:

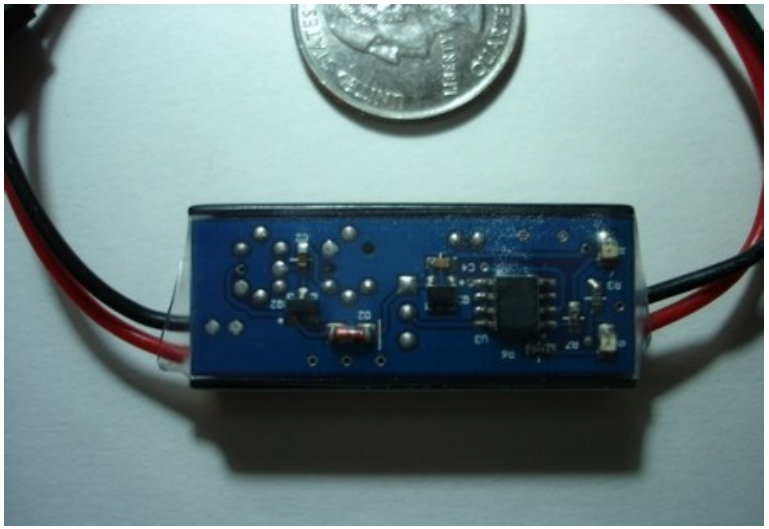


The 20mSec post-pulse bump is reduced as the plane's idle current increases. Almost all planes will have at least 100mA idle current so this anomaly should not be an issue.

Screen 3:

This screen shows how the Vout “floats down” after the pulse load is completely removed. This is due in part to the regulator's extra large output capacitor. This anomaly is greatly reduced with a “real world” idle load as the above 2 screens show.

Picture 2:



This picture shows the shrink-wrap covered back side of the Voltron unit. It is strongly recommended that you tape a layer of thin foam to this side to prevent impact with the inside fuselage on hard landings.

NOTES:

1. The Voltron's red led is permanently on for all voltages that can come from a LiFe 2S pack. The only time the green led is illuminated is when the input voltage goes above 7.0v.