SRM Unmanned Aerial Vehicle
Developmental Testing for Buck Convertor
Part 1 : Software Analysis
18 July 2019
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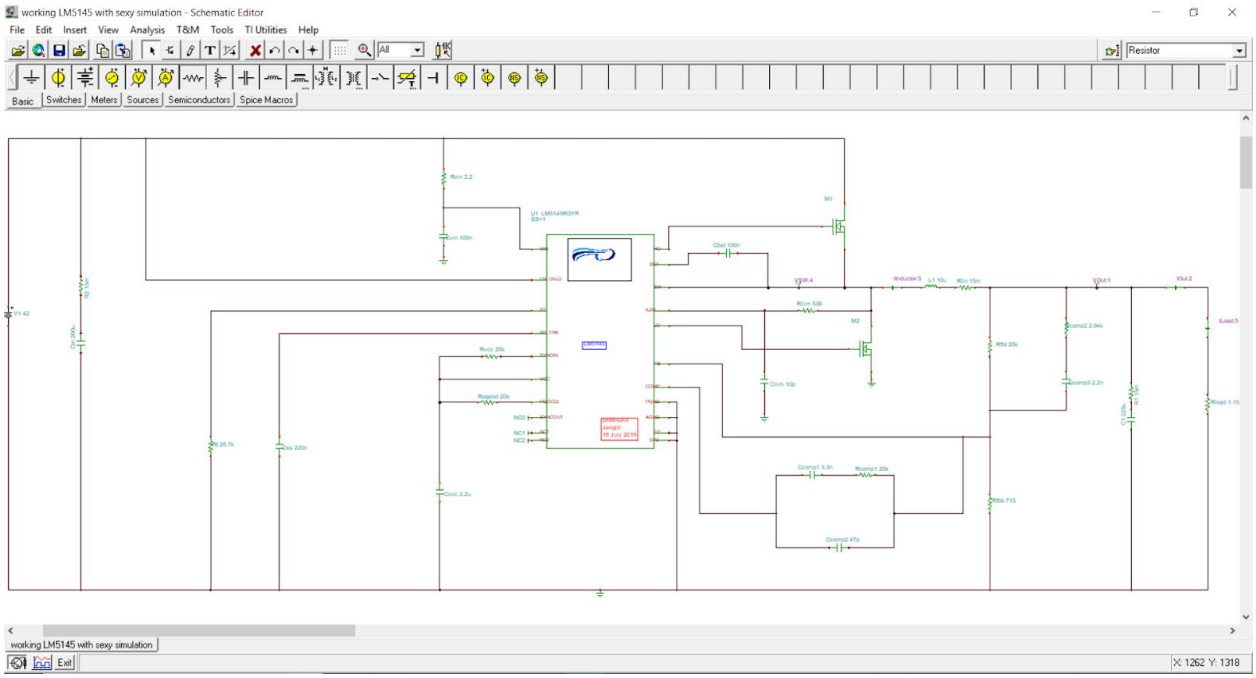


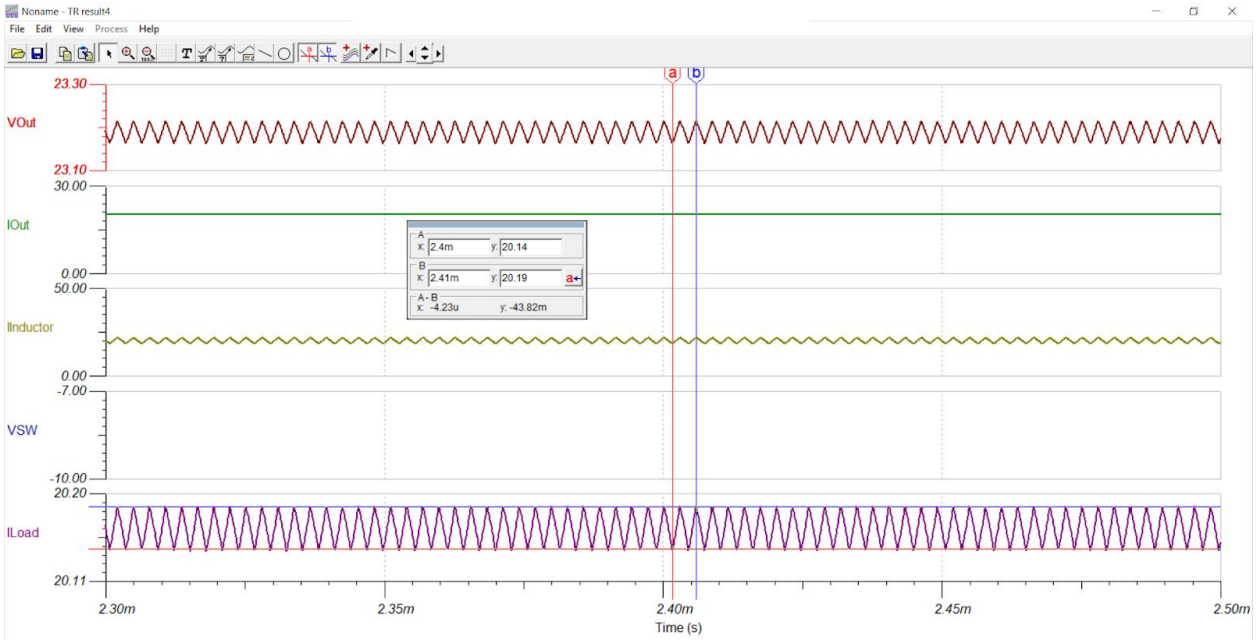
1. Capable of maintaining a constant Output of 23V for powering the motors whatsoever be the state of the battery pack.
2. The heart of the buck is a **Texas Instruments LM5145** Buck Regulator.
3. Three of these operate in parallel to each other with their outputs interleaved.
4. The maximum rated Current draw is **80A.**
5. An External phase shifted clock Pulse is Supplied from the Linear Technologies timer IC to the three bucks.
6. Capable of handling Inputs ranging from 25V to 50V.
7. Has the ability of providing extremely low output ripple .
8. Extremely fast response time to the Load transient.
9. Reached Steady state in just 662 microseconds.
10. Overcurrent Protection Feature.
11. Low Cost Design.

Bill of Materials

Count	Ref Des	Value	Description
1	C_{BOOT}	0.1µF	Capacitor, Ceramic, 0.1µF, 25V, X7R, 20%
1	C_{C1}	3300pF	Capacitor, Ceramic, 3300pF, 16V, X7R, 10%
1	C_{C2}	47pF	Capacitor, Ceramic, 47pF, 50V, NP0, 5%
1	C_{C3}	2200pF	Capacitor, Ceramic, 2200pF, 50V, NP0, 5%
1	C_S	10pF	Capacitor, Ceramic, 10pF, 100V, X7R, 20%
20	C_{IN}	4.7µF	Capacitor, Ceramic, 4.7µF, 100V, X7S, 10%
23	C_{OUT}	10µF	Capacitor, Ceramic, 10µF, 50V, X7R, 10%
1	C_{SS}	220nF	Capacitor, Ceramic, 220nF, 16V, X7R, 10%
1	C_{VCC}	2.2µF	Capacitor, Ceramic, 2.2µF, 25V, X7R, 20%
1	C_{VIN}	0.1µF	Capacitor, Ceramic, 0.1µF, 50V, X7R, 20%
1	L_F	10µH	Inductor, 10µH, 14mΩ, >38A
1	Q_1	See description	MOSFET, N-CH, 80V/100V, 12mΩ
1	Q_2	See description	MOSFET, N-CH, 80V/100V, 3.9mΩ
1	R_{C1}	20k	Resistor, Chip, 20kΩ, 1/16W, 1%
1	R_{C2}	2940	Resistor, Chip, 2940Ω, 1/16W, 1%
1	R_{ILIM}	536	Resistor, Chip, 536Ω, 1/16W, 1%
1	R_{RT}	28.7k	Resistor, Chip, 28.7kΩ, 1/16W, 1%
1	R_{FB1}	20k	Resistor, Chip, 20kΩ, 1/16W, 1%
1	R_{FB2}	0.715k	Resistor, Chip, 0.715kΩ, 1/16W, 1%
1	R_{PGOOD}	20k	Resistor, Chip, 20kΩ, 1/16W, 1%
1	R_{UV1}	499k	Resistor, Chip, 499kΩ, 1/16W, 1%
1	R_{UV2}	24.9k	Resistor, Chip, 24.9kΩ, 1/16W, 1%
1	R_{VIN}	2.2	Resistor, Chip, 2.2Ω, 1/16W, 1%
1	U_1	**LM5145**	**IC, LM5145, PWM Controller, 6V-42V Input**

A. Simulation For Fully charged Voltage of Li-on (12cell Pack)

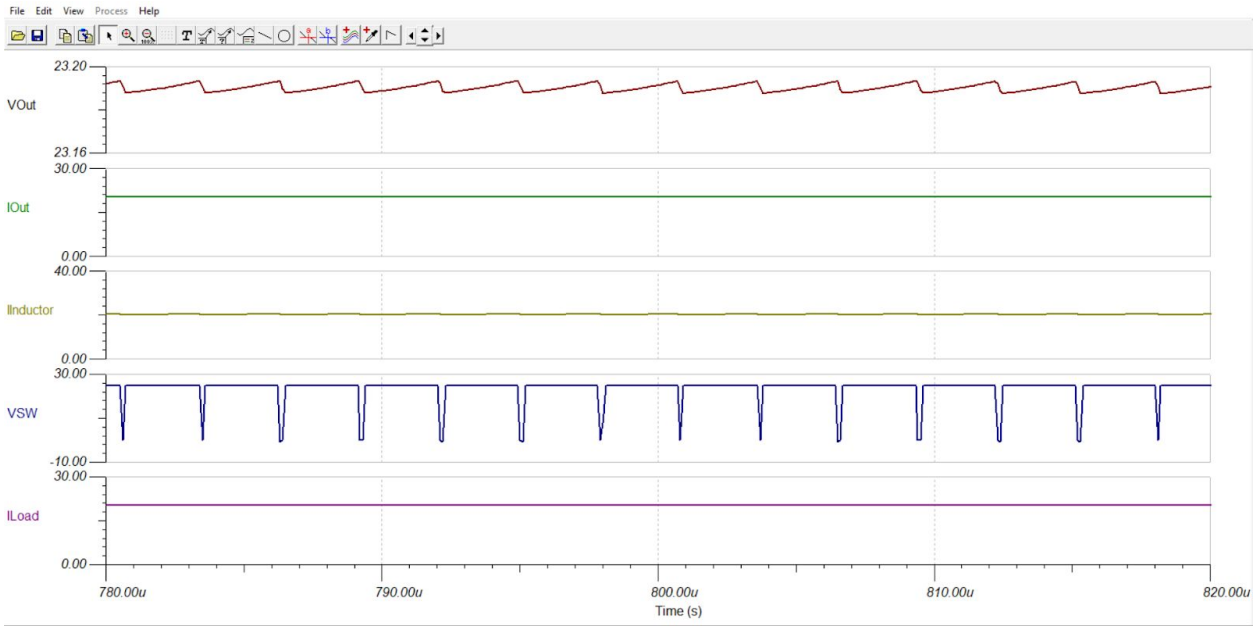
Figure1. (Input Cap. ESR:-15mohm Out Cap. ESR:-15mohm DCR L:-10mohm)



Vin	50V
Iload (Ipk-pk) :-	20.19A-20.14A 0.05A of ripple Current .
Vload :-	23.21V-23.17V 5.51mV ripple Voltage
Switching Frequency	346Khz
	Duty Cycle :- 46.58%
	Ton 1.16us
	Toff 1.33us
Inductor current	Peak current : 40.14A
	During Steady State
	Min. Current :- 18.36A
	Max. Current :- 21.86A

B. Simulation For Discharged voltage of Li-on (10 cell pack)

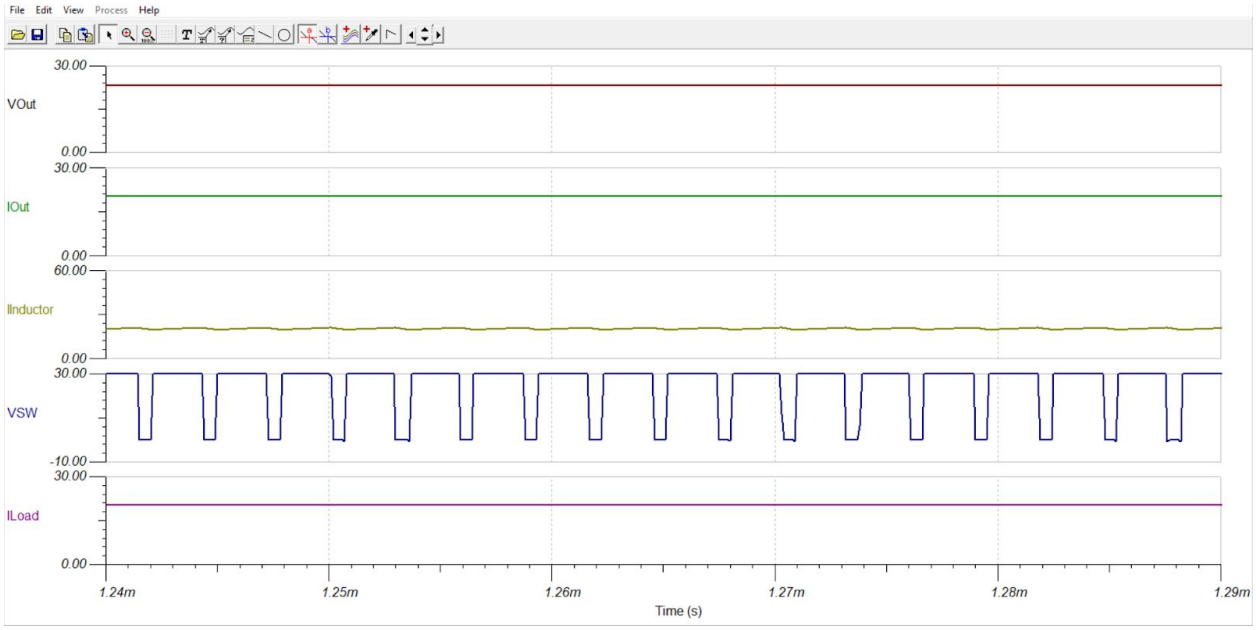
Figure2. (Vin:- 25V Cap. ESR:-15mohm Out Cap. ESR:-15mohm DCR L:-10mohm)



Vin	25V
Switching Frequency	344Khz
	Duty Cycle 96.9%
	Ton :- 2.58us
	Toff :- 81ns
Iload (Ipk-pk) :-	20.16A-20.17 4.16mA
Vload	23.19V 5.33mV of ripple
Inductor	Peak Current :- 62.69A(during start)
	Steady State ripple Current :- 386.58mA
	Max :- 20.36A
	Min :- 19.97A

C. *Simulation for Discharged Li-on (12 cell pack)*

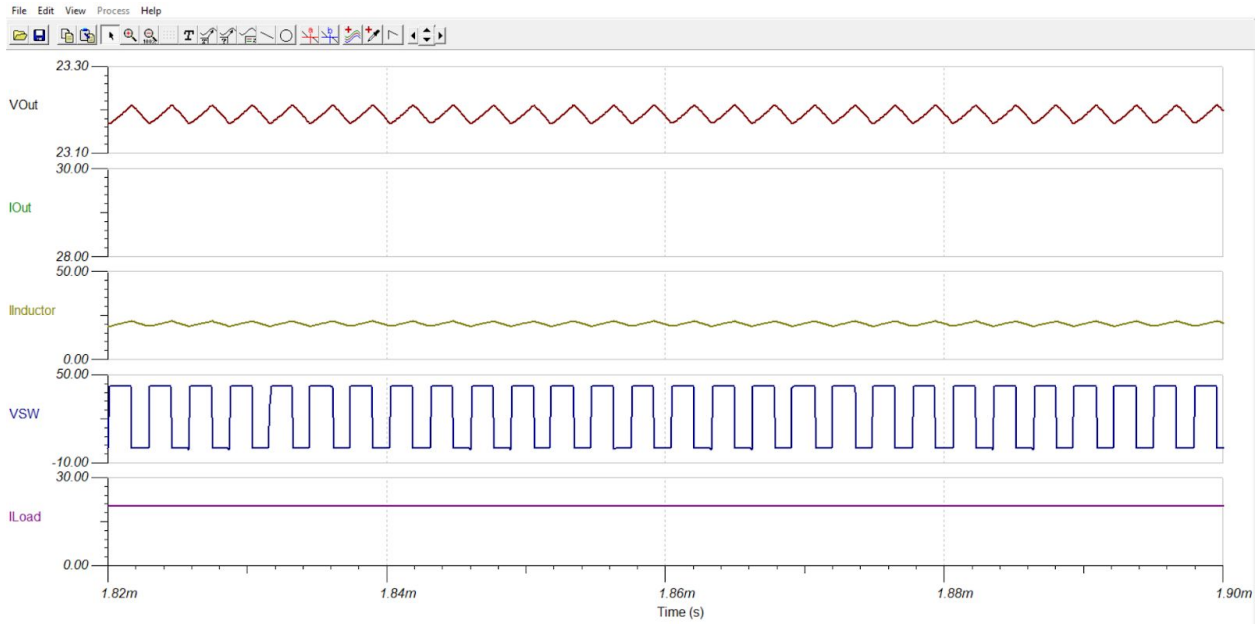
Figure 3. (Vin:- 30V Cap. ESR:-15mohm Out Cap. ESR:-15mohm DCR L:-10mohm)



Vin	30V
Switching Frequency	344.82Khz
	Duty Cycle 78.54%
	Ton 2.19us
	Toff 598.1ns
Iload (Ipk-pk)	20.16A-20.17A 18.32mA
Vload	20.18V-20.20V 20.47mV
Inductor	Peak Current :- 57.21 A(during start)
	Steady State ripple Current :- 1.38A
	Max :- 20.89A
	Min :- 19.50A

D. *Simulation for fully Charged Li-on(10cell Pack)*

Figure 4. (Vin:- 42V In Cap. ESR:-15mohm Out Cap. ESR:-15mohm DCR L:-10mohm)



Vin	42V	
Switching Frequency	343.64Khz	
	Duty Cycle	57.93%
	Ton	1.46us
	Toff	1.06us
Iload	20.15A-20.18A	30.12mA
Vload	23.17V - 23.21V	42.04mV
Inductor	Peak Current :	41.52A
	During Steady State ripple :-2.79A	
	Max. 21.58A	
	Min. 18.79A	