LTM4615EV: Dual DC/DC Step-Down µModule Regulator with LDO

DESCRIPTION

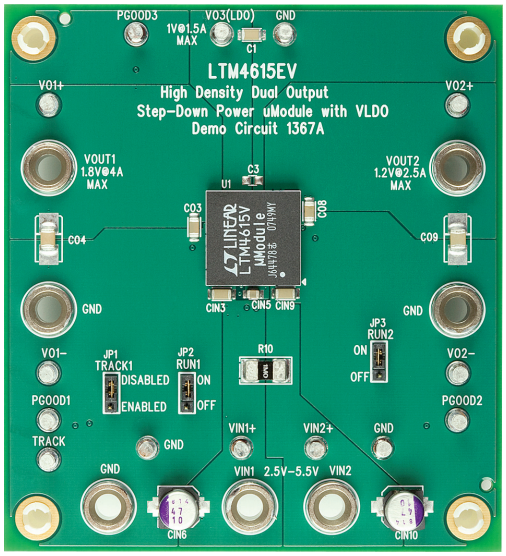
Demonstration circuit 1367A features the LTM®4615EV, a triple output µModule® regulator consisting of two switch mode outputs and one LDO output. Each LTM4615 DC/DC converter has a separate input and enable pin. The LTM4615 maximum load current is 4A for each switch mode channel and 1.5A for the VLDO™ channel. However the DC1367A is configured with the LDO input supply connected to the VOUT2 whose maximum output current decreases accordingly. Derating is necessary for certain V_{IN}, V_{OUT} and thermal conditions. The LTM4615 data sheet must be read in conjunction with this manual prior to working on or modifying DC1367A.

Design files for this circuit board are available at http://www.linear.com/demo

PERFORMANCE SUMMARY (T_A = 25°C)

PARAMETER	CONDITION	VALUE
Input Voltage Range	Both Switch Mode Outputs (V_{IN1} and V_{IN2})	2.5V to 5.5V
Output Voltage V_{OUT1}	DC Voltage, V_{IN1} = 3.3V, I_{OUT1} = 4A	1.8V ±2%
Output Voltage V_{OUT2}	DC Voltage, V_{IN2} = 3.3V, I_{OUT2} = 2.5A	1.2V ±2%
Output Voltage $V_{O3(LDO)}$	DC Voltage, V_{IN2} = 3.3V, I_{OUT3} = 1.5A	1.0V ±2%
Maximum Continuous Output Current	Note: $I_{OUT2} = 4.0A - I_{O3}$	4A DC at V_{OUT1}, 4A DC at V_{OUT2}, 1.5A DC at V_{O3}
Default Operating Frequency	For 2 Switching Mode Channels	1.25MHz
Efficiency of Channel 1	V_{IN1} = 5.5V, V_{OUT1} = 1.8V, I_{OUT1} = 4A	82.8%, See Figure 3
Efficiency of Channel 2	V_{IN2} = 5.5V, V_{OUT2} = 1.2V, I_{OUT2} = 2.5A	81.7%, See Figure 3

BOARD PHOTO



QUICK START PROCEDURE

Demonstration circuit 1367A is an easy way to evaluate the performance of the LTM4615. Please refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. Place jumpers in the following positions for a typical 1.8V, 1.2V and 1.0V application:

TRACK1	RUN1	RUN2
DISABLED	ON	ON

2. With power off, preset the loads to 0A and V_{IN} supply to be 5V. Connect the input power supply, load and meters as shown in Figure 1.
3. Turn on the power at the input. The output voltage between VO1+ and VO1– should be 1.8V ± 2%, the voltage between VO2+ and VO2– should be 1.2V ± 2%, and the voltage between VO3(LDO) and GND should be 1.0V ±2%.
4. Once the proper output voltage is established, adjust the load within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters. To measure input and output ripple, please refer to Figure 2 for proper setup.
5. VOUT1 can track another supply by connecting TP14, TRACK to the supply rail and setting JP1 to ENABLED. When R8 equals RSET1, VOUT1 is set up for coincidental tracking. VOUT2 is set up to coincidentally track VOUT1 as determined by resistors R6 and R7. Please refer to the circuit schematic and data sheet.
6. VOUT2 is used as the input supply for the 1.5A LDO. Therefore, if the jumper of JP3 (RUN2) is placed at OFF position, both channel 2 and 3 will be turned off.
7. Because DC1367A is designed so VOUT2 tracks VOUT1 automatically, placing the JP2 (RUN1) to OFF position turns off all three outputs. To disable tracking on VOUT2, please remove R6 and R7 and connect TRACK2 to VIN2.
8. VIN1 and VIN2 are shorted on DC1367A through a 1mΩ resistor, R10. If desired, remove R10 to allow separate V_{IN1} and V_{IN2} power supplies.

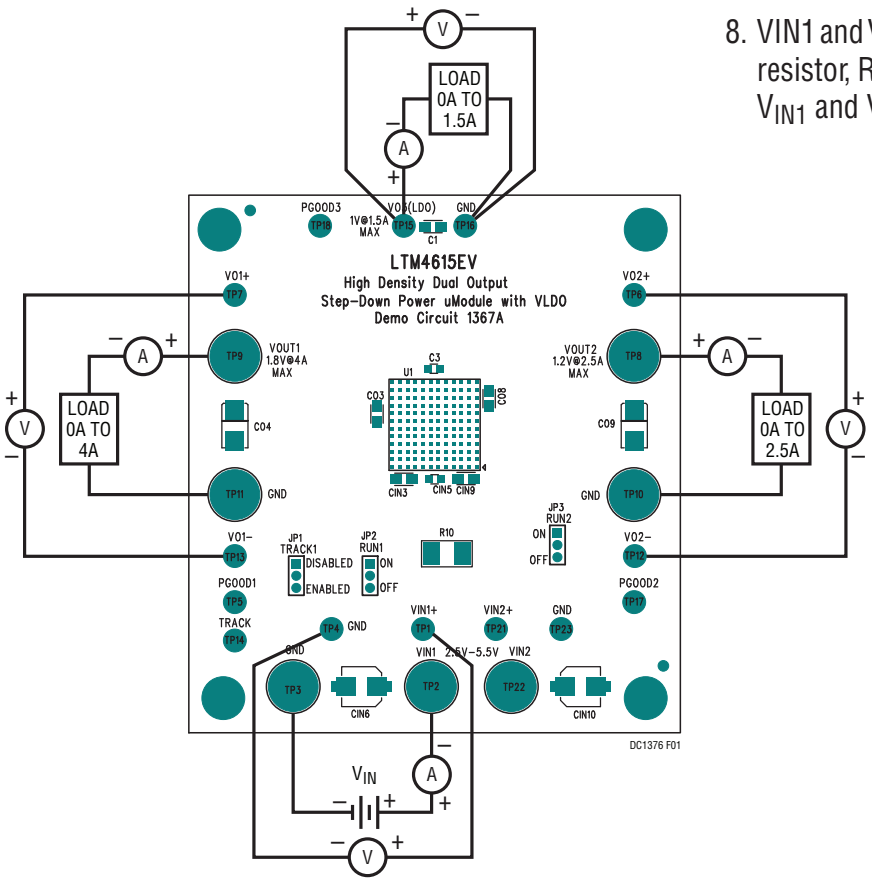


Figure 1. Test Setup of DC1367A

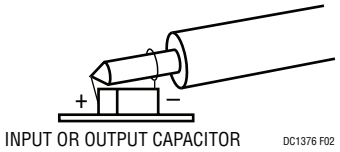


Figure 2. Proper Scope Probe Placement for Measuring Input or Output Ripple

QUICK START PROCEDURE

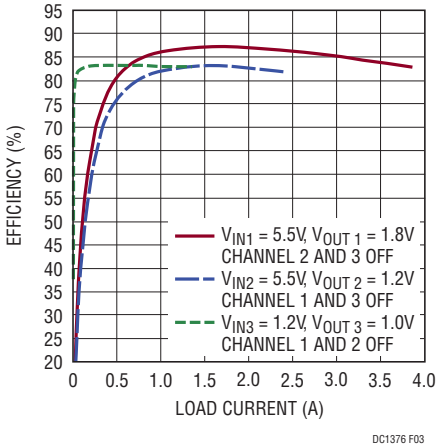
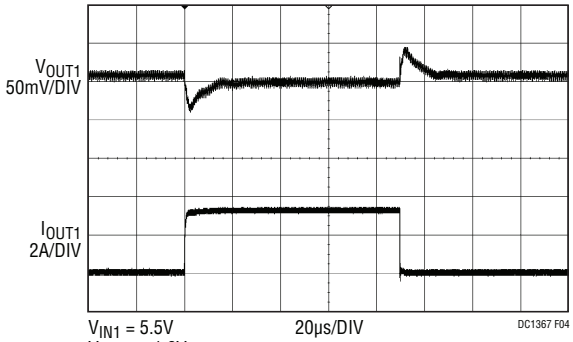
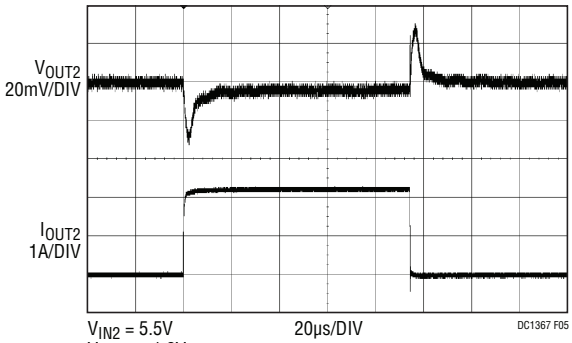


Figure 3. Measured Efficiency for Different Channels



V_{IN1} = 5.5V
V_{OUT1} = 1.8V
V_{OUT2} = 1.2V AT NO LOAD
$V_{O3(LDO)}$ = 1.0V AT NO LOAD
CONTINUOUS CURRENT MODE (CCM)
0A TO 3.4A LOAD STEP ON V_{OUT1}
C_{OUT1} = 100µF CERAMIC (1210, X5R, 6.3V) + 22µF CERAMIC (1206, X5R, 6.3V)

Figure 4. Measured Load Transient Response for V_{OUT1}



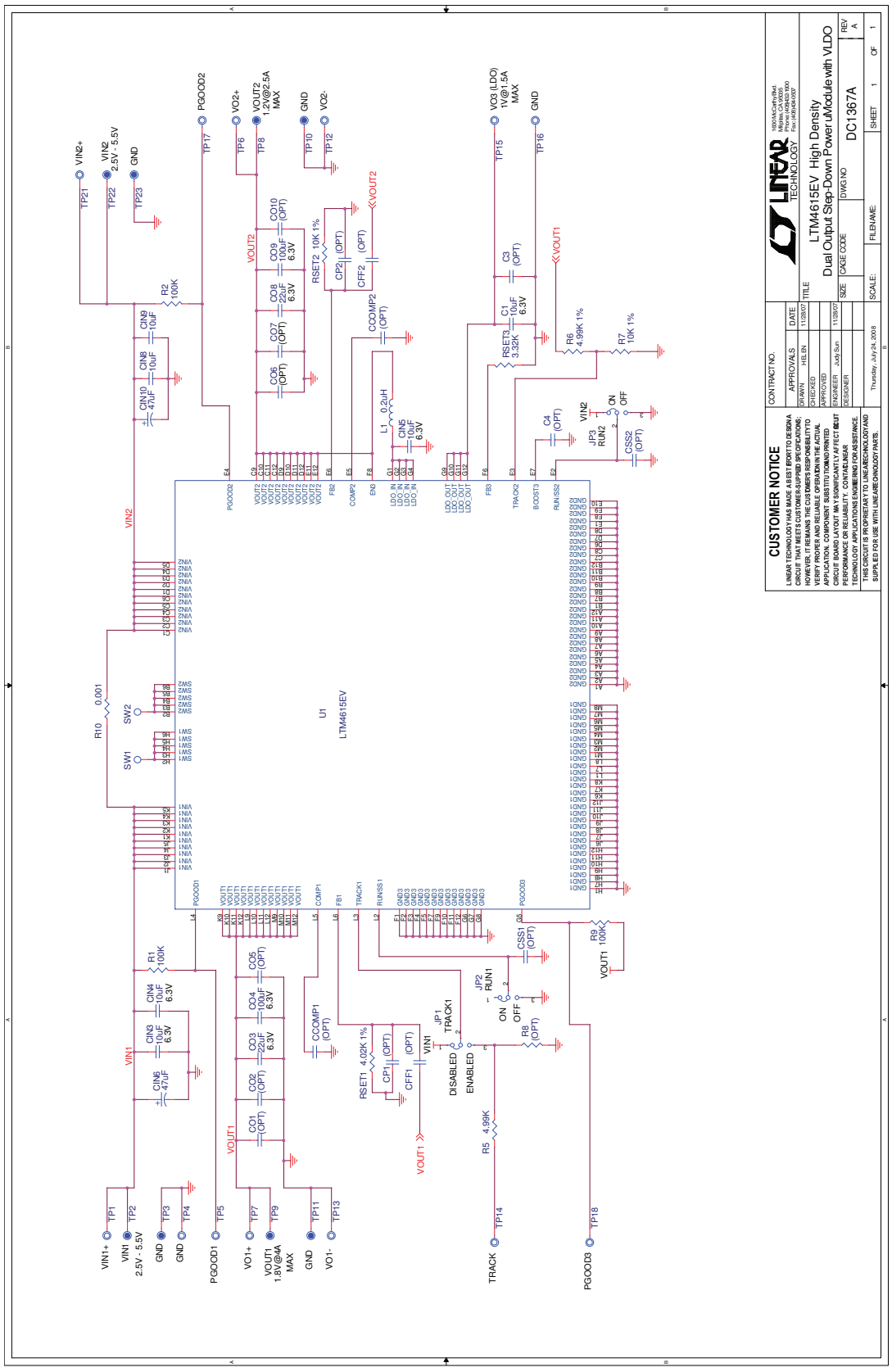
V_{IN2} = 5.5V
V_{OUT2} = 1.2V
V_{OUT1} = 1.8V AT NO LOAD
$V_{O3(LDO)}$ = 1.0V AT NO LOAD
CONTINUOUS CURRENT MODE (CCM)
0A TO 2.2A LOAD STEP ON V_{OUT2}
C_{OUT2} = 100µF CERAMIC (1210, X5R, 6.3V) + 22µF CERAMIC (1206, X5R, 6.3V)

Figure 5. Measured Load Transient Response for V_{OUT2}

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	CIN6, CIN10	CAP., OS-CON, 47µF, 10V, C6 SIZE	SANYO, 10SVP47M
2	2	CO4, CO9	CAP., X5R, 100µF, 6.3V, 10%,1210-7343	AVX, 12106D107KAT2A
3	2	CO3, CO8	CAP., X5R, 22µF, 6.3V, 20%, 1206-0805	AVX, 12066D226MAT2A
4	5	C1, CIN3, CIN4, CIN8, CIN9	CAP., X5R, 10µF, 6.3V, 20%, 1206-0805	AVX, 12066D106MAT2A
5	1	CIN5	CAP., X5R, 10µF, 6.3V, 20%, 0805-0603	AVX, 08056D106MAT2A
6	1	L1	IND, 0.2µH	Fair-Rite, 2508056017Y2
7	1	RSET1	RES., CHIP, 4.02k, 1/16W, 1%, 0603	VISHAY, CRCW06034K02FKEA
8	2	RSET2, R7	RES., CHIP, 10k, 1/16W, 1%, 0603	VISHAY, CRCW060310K0FKEA
9	1	RSET3	RES., CHIP, 3.32k, 1/16W, 1%, 0603	VISHAY, CRCW060333K2FKEA
10	3	R1,R2, R9	RES., CHIP, 100k, 1/16W, 1%, 0603	VISHAY, CRCW0603100KFKEA
11	1	R6	RES., CHIP, 4.99k, 1/16W, 1%, 0603	VISHAY, CRCW06034K99FKEA
12	1	U1	I.C., LTM4615EV#PBF, LGA	LINEAR TECH., LTM4615EV#PBF
Additional Demo Board Circuit Components				
1	0	CO1, CO6 (OPT)	CAP., 1206-0805	
2	0	CSS1, CSS2, CP1, CP2, C3, C4 (OPT)	CAP., 0603	
3	0	COMP1, COMP2, CFF1, CFF2 (OPT)	CAP., 0603	
4	0	CO5, CO7, CO10, CO2(OPT)	CAP., 1210-7343	
5	0	R8	RES., CHIP, 0603	
6	1	R5	RES., CHIP, 4.99k, 1/16W, 1%, 0603	VISHAY, CRCW06034K99FKEA
7	1	R10	RES., CHIP, 1M, 1W, 1%, 2512	PANASONIC, ERJM1WTJ1M0U
Hardware For Demo Board Only				
1	3	JP1, JP2, JP3	2MM SINGLE ROW HEADER, 3 PIN	SAMTEC, TMM-103-02-L-S
2	3	JP1, JP2, JP3	SHUNT,	SAMTEC, 2SN-BK-G
3	7	TP8-TP11, TP22, TP2, TP3	BANANA JACK,	KEYSTONE, 575-4
4	14	TP1, TP4-TP7, TP12-TP18, TP21, TP23	TESTPOINT, TURRET, .095”	MILL-MAX, 2501-2-00-80-00-00-07-0
5	4	STAND OFF	STAND-OFF, NYLON 0.50” tall	KEYSTONE, 8833 (SNAP ON)

SCHEMATIC DIAGRAM



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