LTM4616
Dual 2.7$V_{IN(MIN)}$, 8A Step-Down µModule Regulator

DESCRIPTION

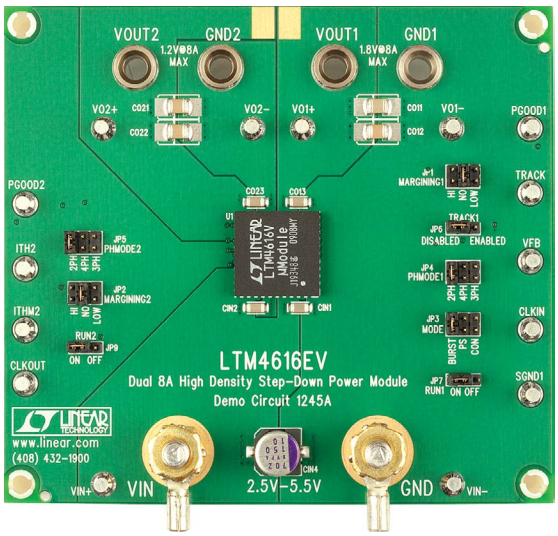
Demonstration circuit 1245A features the LTM®4616, the high efficiency, high density, dual output switch mode power module. The rated load current is 8A for each channel, while derating is necessary for certain V_{IN}, V_{OUT}, and thermal conditions. By applying a clock signal to the CLKIN pin, the module's switching frequency may be synchronized from 0.75MHz to 2.25MHz. The same clock frequency is available at the CLKOUT pin with the phase relationship between CLKIN and CLKOUT determined by the PHMODE pin. This feature can be used not only to reduce undesirable frequency harmonics but also to parallel the two channels of LTM4616 or even multiple LTM4616s and LTM4608s to provide higher output currents. The LTM4616 data sheet must be read in conjunction with this demo manual prior to working on or modifying demo circuit DC1245A.

Design files for this circuit board are available at http://www.linear.com/demo/DC1245A

PERFORMANCE SUMMARY (T_A = 25°C)

PARAMETER	CONDITIONS	VALUE
Input Voltage Range		2.7V to 5.5V
Output Voltage V_{OUT1} V_{OUT2}	V_{IN} = 3.3V, I_{OUT1} = 8A I_{OUT2} = 8A	1.8 ±2% 1.2 ±2%
Maximum Continuous Output Current	Derating Is Necessary for Certain V_{IN}, V_{OUT}, and Thermal Conditions, See Data Sheet for Details	$8A_{DC}$ Each Channel
Default Operating Frequency		1.5MHz
Efficiency	V_{IN} = 5V, V_{OUT1} = 1.8V, V_{OUT2} = 1.2V, 8A Per Channel	77.5%, See Figure 3 for More Information
Load Transient	V_{IN} = 3.3V, V_{OUT1} =1.8V; V_{OUT2} = 1.2V	See Figures 4 and 5 for Details

BOARD PHOTO



QUICK START PROCEDURE

Demonstration circuit 1245A is an easy way to evaluate the performance of the LTM4616. 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_{OUT} and 1.2V_{OUT} application:

PHMODE2	MARGINING2	RUN2	MARGINING1
2PH	NO	ON	NO

TRACK1	PHMODE1	MODE	RUN1
DISABLED	2PH	BURST	ON

2. With power off, connect the input power supply, load and meters as shown in Figure 1. Preset the load to 0A and V_{IN} supply within the 2.7V to 5.5V operating range.
3. Turn on the power at the input. The output voltage at $VO1^+$ and $VO1^-$ should be 1.8V ±2% and the voltage at $VO2^+$ and $VO2^-$ should be 1.2V ±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. To synchronize channel 1 to an external clock, please apply the desired clock signal to CLKIN and SGND1. The external clock signal should have amplitude of at least 2V but less than V_{IN}.
6. V_{OUT1} can track another supply connected at TP20 as determined by resistors R6 and R17. V_{OUT2} is set up to track V_{OUT1} in a manner determined by resistors R15 and R16. By default both resistor pairs have been selected to support coincident tracking. Please refer to Figure 6 for reference.

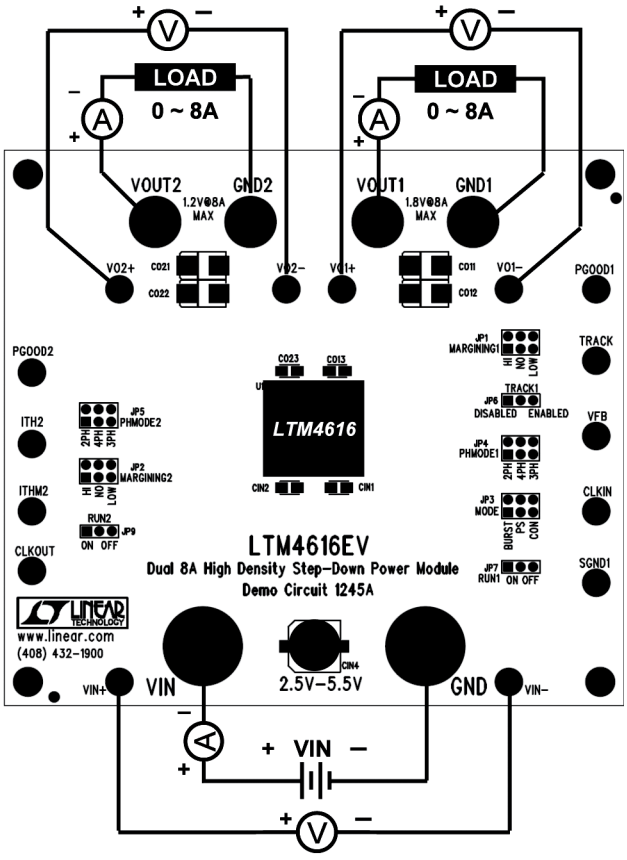


Figure 1. Test Setup of DC1245A

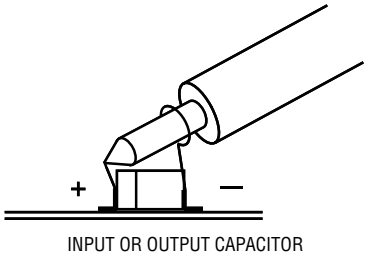


Figure 2. Proper Scope Probe Placement for Measuring Input or Output Ripple

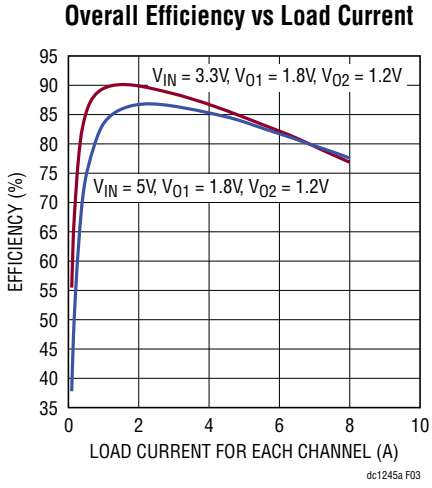
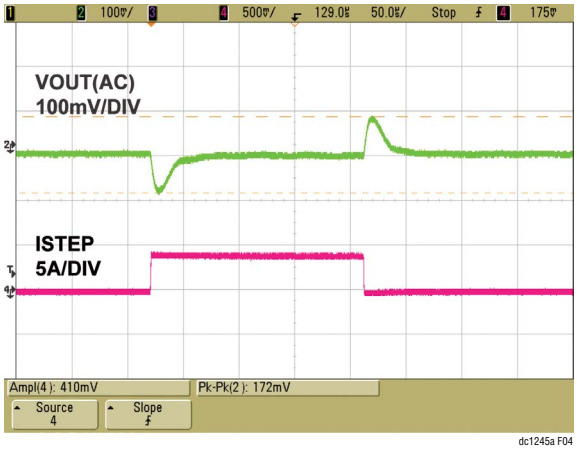


Figure 3. Measured Overall Supply Efficiency with Different V_{IN}

QUICK START PROCEDURE

7. Channel 2 is set up to synchronize to the CLKOUT signal of channel 1. The default phase difference is 180°. Please refer to data sheet for how to set up PHMODE1 and PHMODE2 for paralleling more than 2 channels.



V_{IN} = 3.3V
V_{OUT} =1.8V
CONTINUOUS CURRENT MODE (CCM)
2A TO 6A LOAD STEP
C_{OUT} = ×2 100µF CERAMIC (1210, X5R, 6.3V) +
22µF CERAMIC (0805, X5R, 6.3V)
C_{FF1} = 47pF
V_{OUT} OVERSHOOT AND UNDERSHOOT = 172mV

Figure 4. Measured Load Transient Response for 1.8V_{OUT} (4A Step, 25% to 75%)

V_{IN} = 3.3V
V_{OUT} =1.2V
CONTINUOUS CURRENT MODE (CCM)
2A TO 6A LOAD STEP
C_{OUT} = ×2 100µF CERAMIC (1210, X5R, 6.3V) +
22µF CERAMIC (0805, X5R, 6.3V)
C_{FF2} = 0pF
V_{OUT} OVERSHOOT AND UNDERSHOOT = 128mV

Figure 5. Measured Load Transient Response for 1.2V_{OUT} (4A Step, 25% to 75%)

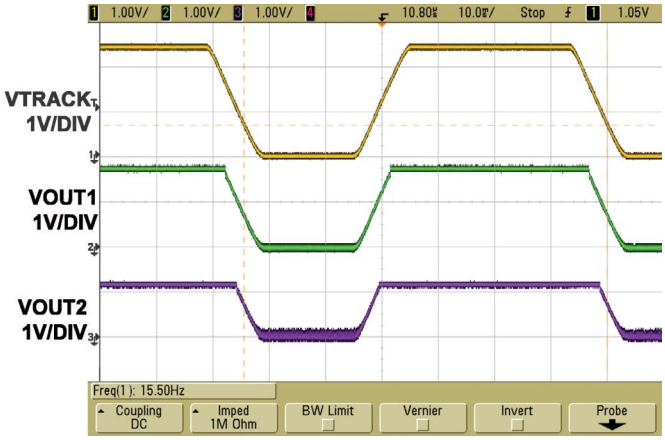
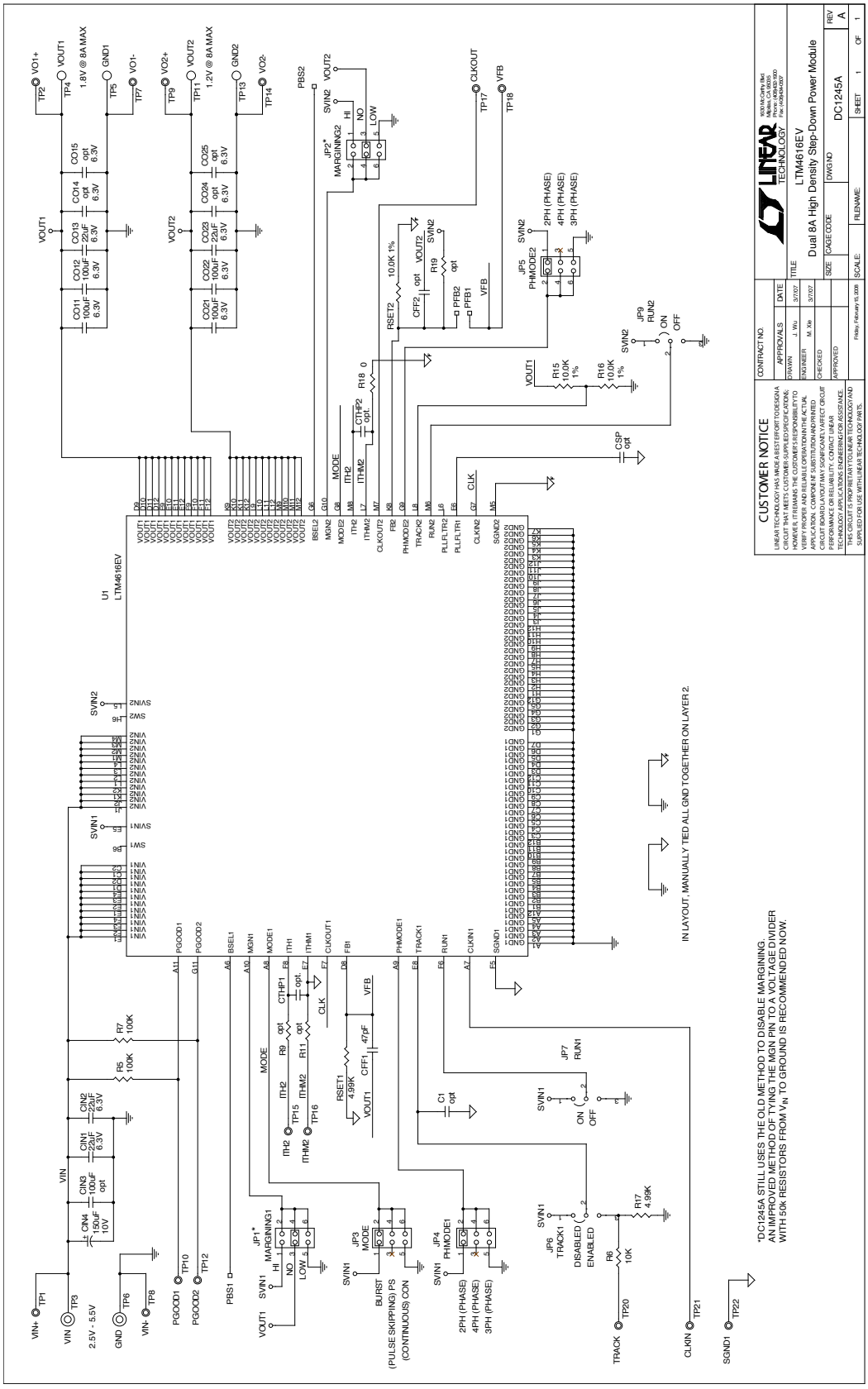


Figure 6. Measured Tracking Performance of V_{OUT1} and V_{OUT2} (with 2A Load Current)

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	4	CIN1, CIN2, CO13, CO23	Capacitor, X5R, 22µF, 6.3V, 20%, 1206	AVX, 12066D226MAT2A
2	1	CIN4	Capacitor, OS-CON, 150µF, 10V, E7 Size	Sanyo, 10SVPA150MAA
3	4	CO11, CO12, CO21, CO22	Capacitor, X5R, 100µF, 6.3V, 20%, 1210	AVX, 12106D107MAT2A
4	1	RSET1	Resistor, Chip, 4.99k, 1/16W, 1%, 0402	Vishay, CRCW04024K99FKED
5	1	RSET2	Resistor, Chip, 10k, 1/16W, 1%, 0402	Vishay, CRCW040210K0FKED
6	1	U1	IC LTM4616EV 144-Pin LGA	Linear Technology, LTM4616EV
Additional Demo Board Circuit Components				
1	0	CO14, CO15, CO24, CO25 (OPT)	Capacitor, 1210-3743	
2	2	R7, R5	Resistor, Chip, 100k, 1/16W, 5%, 0402	Vishay, CRCW0402100KJNED
3	0	R9, R11, R19 (OPT)	Resistor, Chip, 0402	
4	0	CTHP1, CTHP2, C1, CFF2, CSP (OPT)	Capacitor, 0402	
5	1	CFF1	Capacitor, C0G, 47pF, 50V, 10%, 0402	AVX, 04025A470KAT2A
6	1	R17	Resistor, Chip, 4.99k, 1/16W, 1%, 0402	Vishay, CRCW04024K99FKED
7	3	R15, R16, R6	Resistor, Chip, 10k, 1/16W, 1%, 0402	Vishay, CRCW040210K0FKED
8	1	R18	Resistor, Chip, 0, 1/16W, 0402	Vishay, CRCW04020000Z0ED
Hardware/Components (For Demo Board Only)				
1	0	CIN3(OPT)	Capacitor, 1210-3743	
2	5	JP1, JP2, JP3-JP5	2 × 3, 0.079 Double Row Header	Samtec, TMM103-02-L-D
3	3	JP6, JP7, JP9	Header 3-Pin 0.079 Single Row	Samtec, TMM103-02-L-S
4	8	JP1-JP7, JP9	Shunt, 0.079" Center	Samtec, 2SN-BK-G
5	15	TP1, TP2, TP7-TP10, TP12, TP14-TP18, TP20-TP22	Testpoint, Turret, 0.094" Pbf	Mill-Max, 2501-2-00-80-00-00-07-0
6	2	TP6, TP3	Stud, Test Pin	PEM KFH-032-10
7	4	TP6, TP3	Nut, Brass Nuts #10-32	Any #10-32
8	2	TP6, TP3	Ring, Lug Ring #10	Keystone #10
9	2	TP6, TP3	Washer, Tin Plated Brass	Any #10
10	4	TP4, TP5, TP11, TP13	Jack Banana	Keystone, 575-4
11	4	(STAND-OFF)	Stand-Off, Nylon 0.50"	Keystone, 8833(SNAP ON)

SCHEMATIC DIAGRAM



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