LTC3622EDE
17V, Dual 1A, Synchronous Step-Down Regulator with Ultralow Quiescent Current

DESCRIPTION

Demonstration circuit 2003A is a synchronous step-down regulator using the power-saving LTC3622EDE monolithic buck regulator in a compact 14-pin DFN (4mm × 3mm) package. The DC2003A operates from an input voltage range of 2.7V to 17V and provides dual 1A outputs with an adjustable output voltage range from 1.2V to 5V. The LTC3622 IC quiescent current can be as low as 5µA in Burst Mode® operation with both channels enabled and less than 0.1µA in shutdown mode. The switching frequency is fixed to 1MHz or 2.25MHz with a ±50% synchronization range to an external clock. A user-selectable mode input is provided to allow the user to trade off ripple noise for light load efficiency. Burst Mode operation provides the highest efficiency at light loads, while pulse-skipping mode provides the lowest ripple noise.

It is recommended to read the data sheet LTC3622 with this demo manual prior to working on or making any changes to DC2003A.

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

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	VALUE
Default IC		LTC3622EDE
Default Switching Frequency		1MHz
Default Operation Mode		Burst Mode Operation
Input Voltage Range		2.7V to 17V
Onboard User Selectable Output Voltages	V_{IN} = 2.7V to 17V, I_{OUT1} = I_{OUT2} = 0A to 1A ($V_{OUT} \le V_{IN}$)	V_{OUT1}: 1.2V, 1.8V, 2.5V, 3.3V V_{OUT2}: 1.5V, 1.8V, 3.3V, 5V
Default Output Voltage		V_{OUT1} = 3.3V V_{OUT2} = 5V
Per Channel Maximum Continuous Output Current	V_{IN} = 2.7V to 17V	I_{OUT1} = I_{OUT2} = 1A
Efficiency, V_{OUT1} (Burst Mode Operation)	V_{IN} = 12V, V_{OUT1} = 3.3V, I_{OUT1} = 1A	88.2% (See Figure 3)
Efficiency, V_{OUT2} (Burst Mode Operation)	V_{IN} = 12V, V_{OUT2} = 5.V, I_{OUT2} = 1A	90.8% (See Figure 4)
Output Voltage Ripple, V_{OUT1}	V_{IN} = 12V, V_{OUT1} = 3.3V, I_{OUT1} = 1A	<5.9mV$_{P-P}$ (See Figure 5)
Output Voltage Ripple, V_{OUT2}	V_{IN} = 12V, V_{OUT2} = 5V, I_{OUT2} = 1A	<7.8mV$_{P-P}$ (See Figure 6)
Load Transient Response, V_{OUT1}	V_{IN} = 12V, V_{OUT1} = 3.3V, I_{OUT1} = 100mA to 1A	See Figure 7
Load Transient Response, V_{OUT2}	V_{IN} = 12V, V_{OUT2} = 5V, I_{OUT2} = 100mA to 1A	See Figure 8
Thermal Image	V_{IN} = 12V, V_{OUT1} = 3.3V, V_{OUT2} = 5V, I_{OUT1} = I_{OUT2} = 1A	See Figure 9

QUICK START PROCEDURE

Demonstration circuit 2003A is easy to set up to evaluate the performance of the LTC3622. Please refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. Place jumpers in the following positions:

Table 1. Jumper Selection

JP1	JP2	JP3	JP4	JP5
RUN1	RUN2	MODE/SYNC	PHASE	ILIM
ON	ON	BURST	180°	1A

2. Place VO1 SELECT jumper in 3.3V position (JP9) and VO2 SELECT jumper in 5V position (JP14).
3. With power off, connect the input power supply at V_{IN1} and GND.
4. Connect the Loads between V_{OUT1} and GND, V_{OUT2} and GND. Preset the loads to 0A.
5. Connect the DMMs to the input and output to monitor the input voltage and output voltages.
6. Turn on the power supply at the input. The RUN1 and RUN2 pin jumpers should be at ON position. Measure and make sure the input supply voltage is 12V. The output voltage V_{OUT1} should be 3.3V±1%, and V_{OUT2} should be 5V±1%.
7. Once the input and output voltages are properly established adjust the loads within the operating range (0A to 1A max) and observe the output voltage regulations, output ripple voltages, switch node wave-forms and other parameters. Refer to Figure 2 for proper input/output voltage ripple measurement.
8. To select other output voltages, use the on board user selectable output voltage jumpers. Shutting down LTC3622 by placing RUN1 and RUN2 pin jumpers to the OFF position or turn off the input power supply. Refer to the following tables (Table 2 and Table 3) for the output voltage selections and repeat step 3 to 6:

Table 2. V_{OUT1} Jumper Selection

JP6	JP7	JP8	JP9	JP10
1.2V	1.8V	2.5V	3.3V	*USER SELECT

Table 3. V_{OUT2} Jumper Selection

JP11	JP12	JP13	JP14	JP15
1.5V	1.8V	3.3V	5V	*USER SELECT

***Note:** If JP10 or JP15 is selected, R5 or R15 needs to be calculated and inserted to obtain the desired output voltage.

Note 1: To measure the input/output voltage ripple properly, do not use the long ground lead on the oscilloscope probe. See Figure 2 for the proper scope probe technique. Short, stiff leads need to be soldered to the (+) and (–) terminals of an output capacitor. The probe's ground ring needs to touch the (–) lead and the probe tip needs to touch the (+) lead.

Note 2: DC2003A can also be used to evaluate LTC3622EDE-2 (2.25MHz) by simply changing U1 to LTC3622EDE-2, L1 to 1µH (Coilcraft XFL4020-102ME) and L2 to 2.2µH (Coilcraft XFL4020-222ME).

QUICK START PROCEDURE

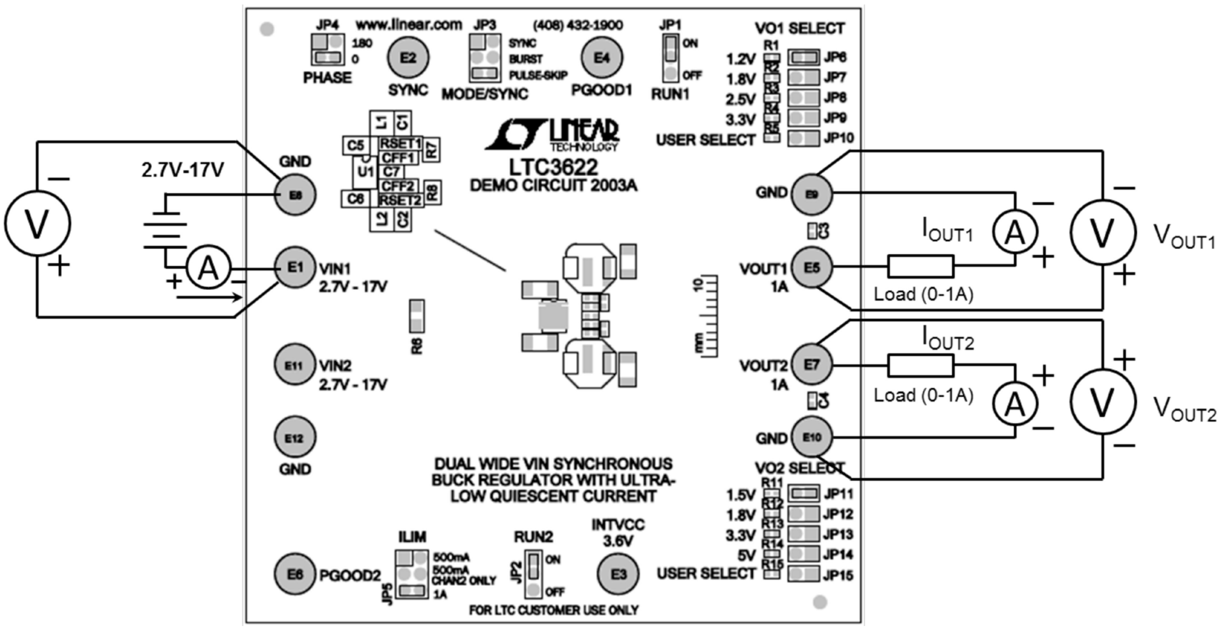


Figure 1. Proper Equipment Measurement Setup

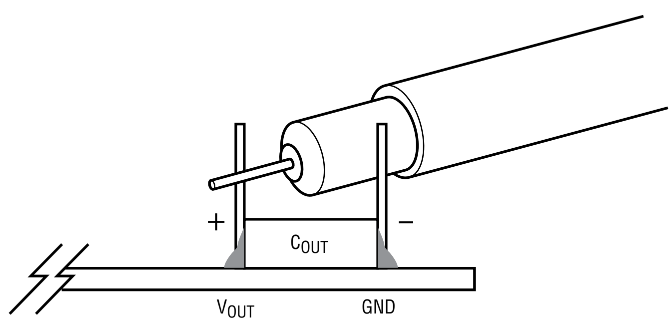


Figure 2. Scope Probe Placements for Measuring Input or Output Ripple

QUICK START PROCEDURE

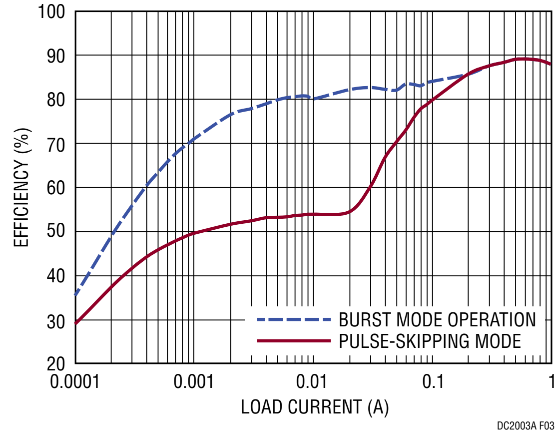


Figure 3. V_{OUT1} Measured Efficiency at V_{IN} = 12V, V_{OUT1} = 3.3V, L1 = 3.3µH, F_{SW} = 1MHz (with V_{OUT2} OFF)

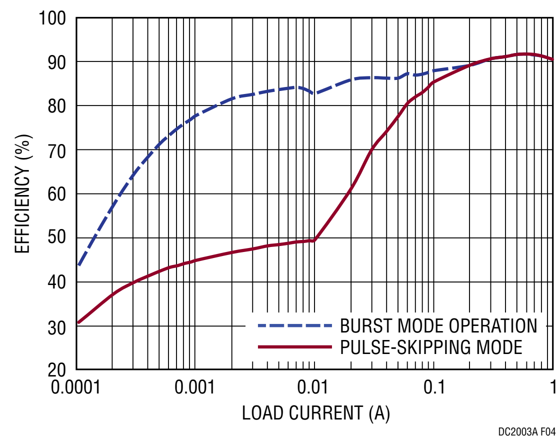


Figure 4. V_{OUT2} Measured Efficiency at V_{IN} = 12V, V_{OUT2} = 5V, L2 = 4.7µH, F_{SW} = 1MHz (with V_{OUT1} OFF)

QUICK START PROCEDURE

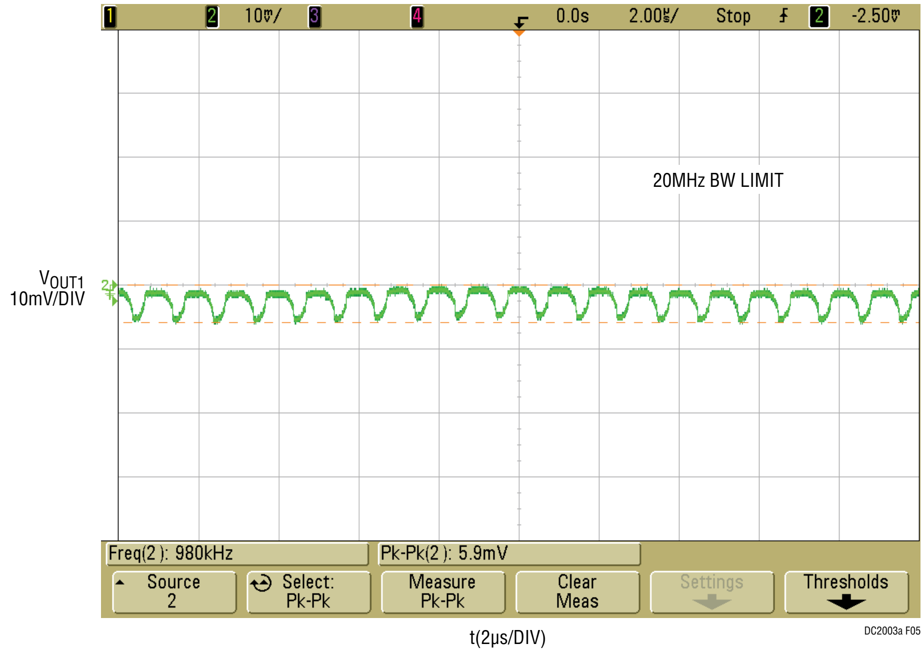


Figure 5. V_{OUT1} Measured Output Voltage Ripple at V_{IN} = 12V, V_{OUT1} = 3.3V, I_{OUT1} = 1A, F_{SW} = 1MHz

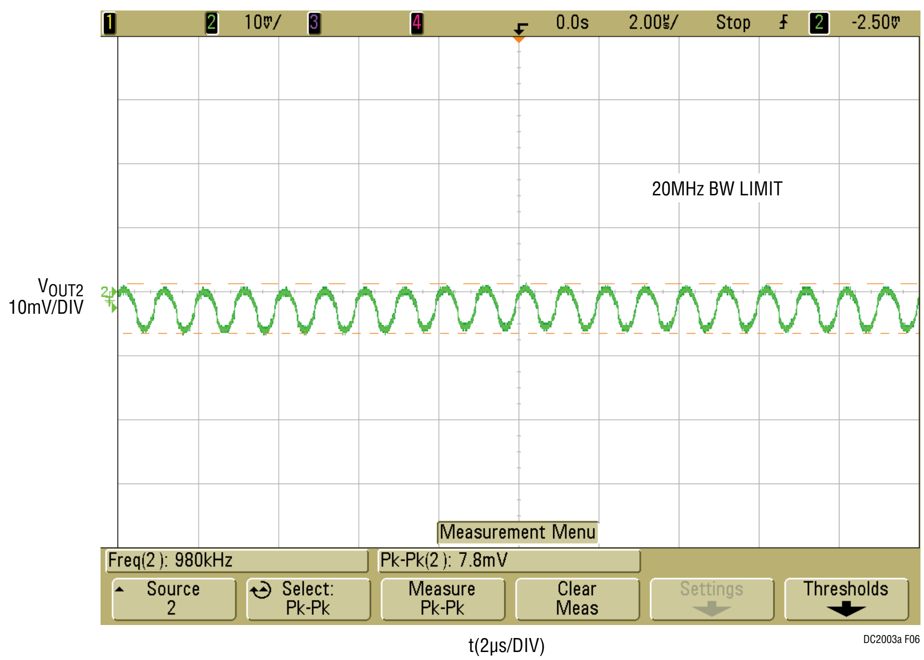


Figure 6. V_{OUT2} Measured Output Voltage Ripple at V_{IN} = 12V, V_{OUT2} = 5V, I_{OUT2} = 1A, F_{SW} = 1MHz

QUICK START PROCEDURE

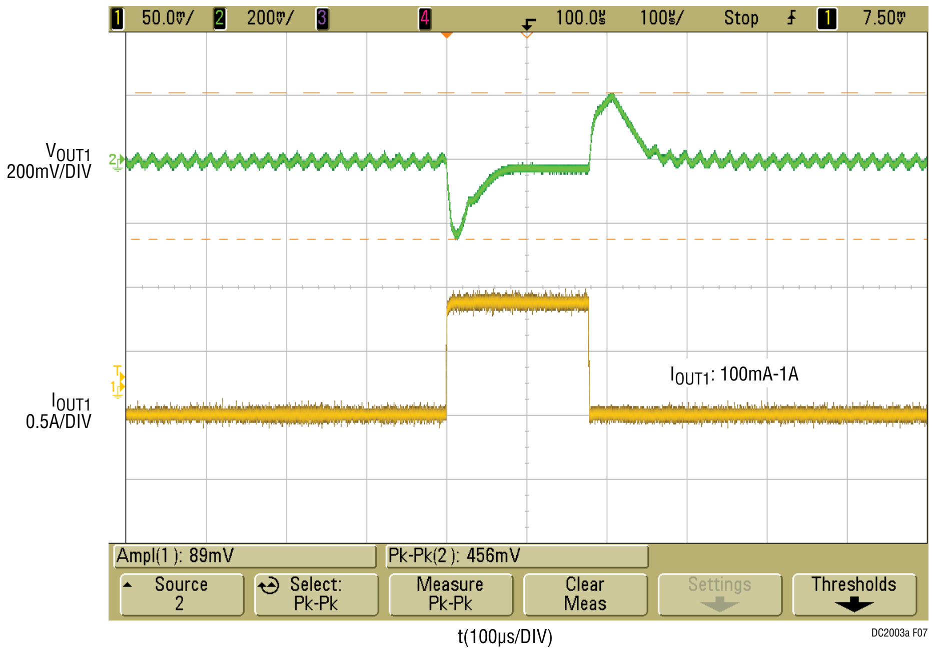


Figure 7. Load Transient Response at V_{IN} = 12V, V_{OUT1} = 3.3V, I_{OUT1} = 100mA-1A, F_{SW} = 1MHz, Burst Mode Operation

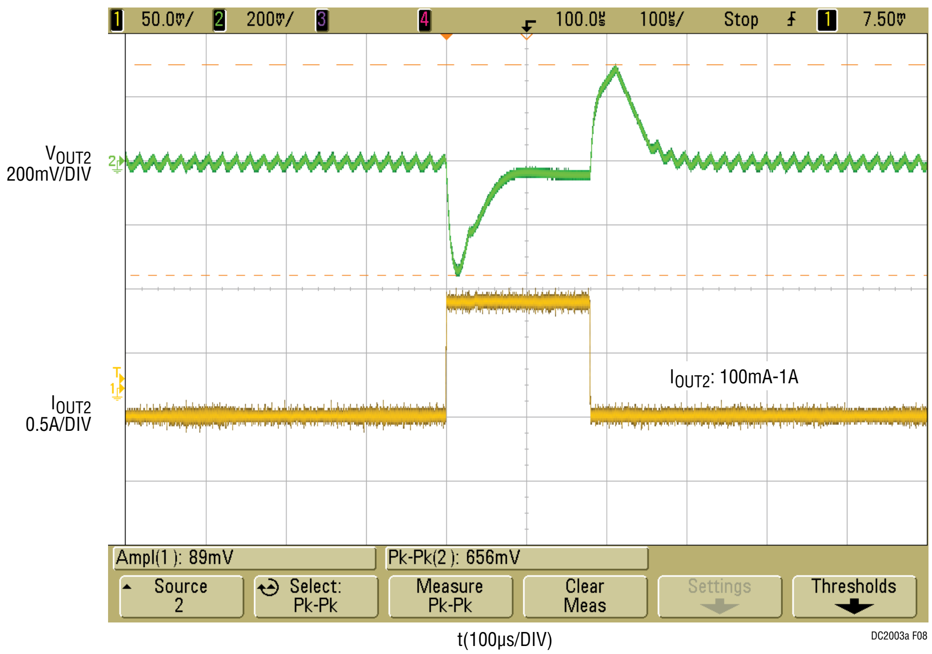


Figure 8. Load Transient Response at V_{IN} = 12V, V_{OUT2} = 5V, I_{OUT2} = 100mA-1A, F_{SW} = 1MHz, Burst Mode Operation

QUICK START PROCEDURE

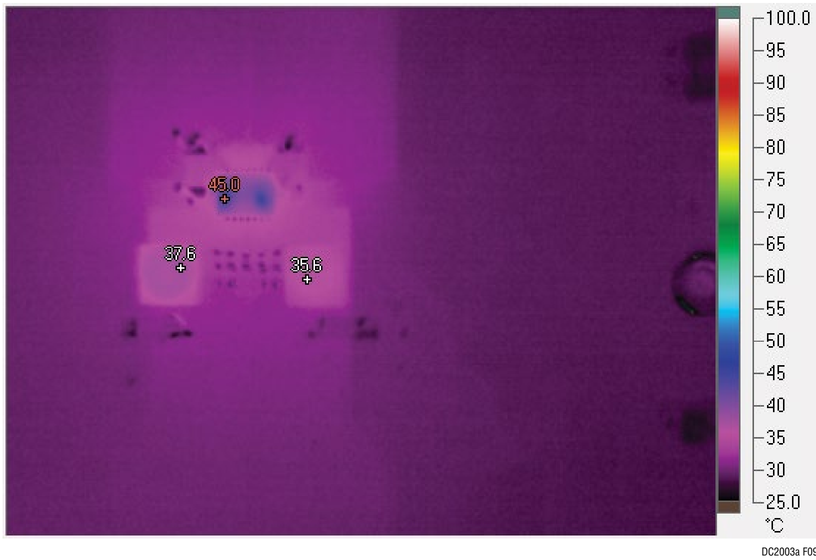
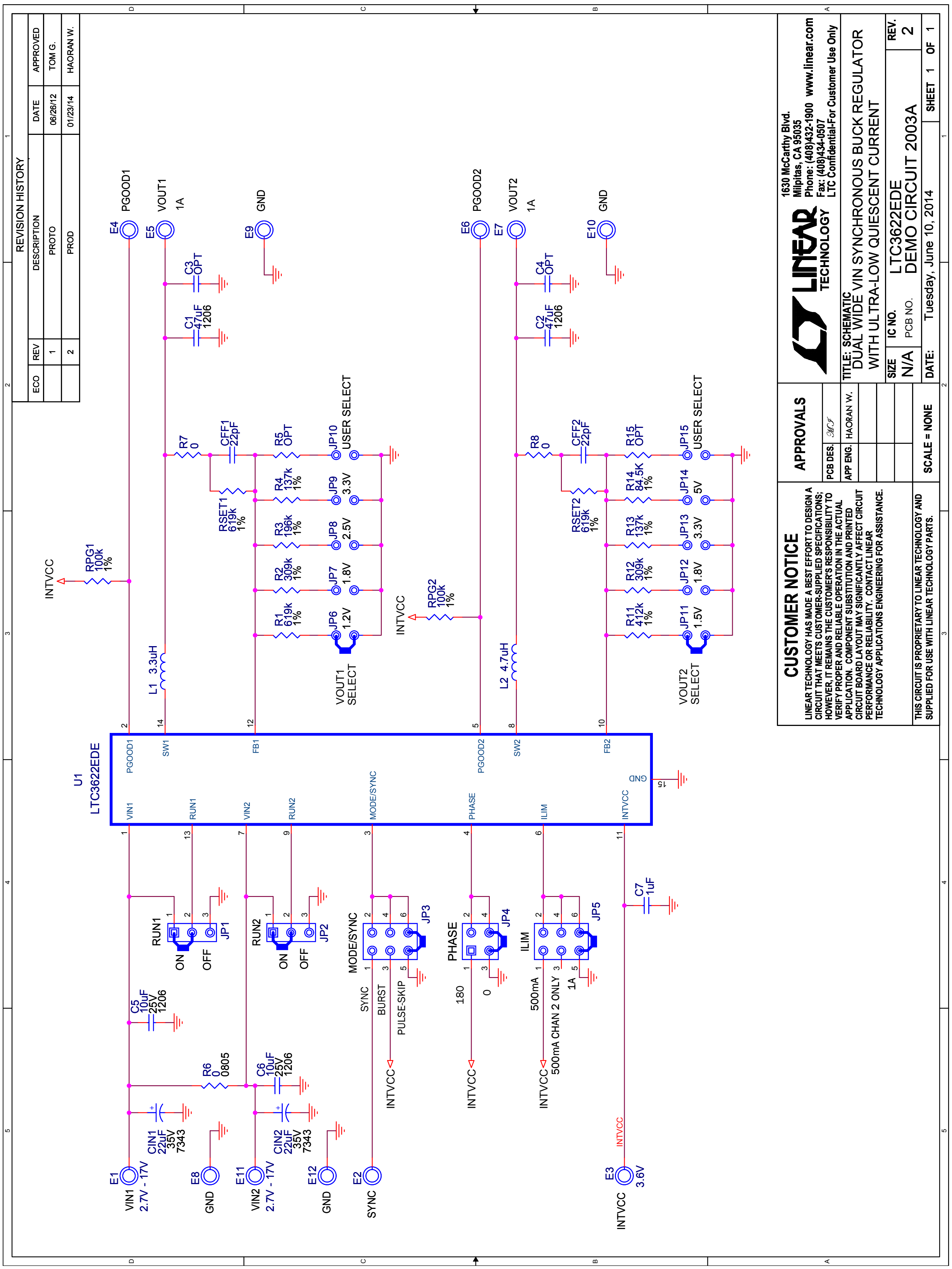


Figure 9. Thermal Performance at V_{IN} = 12V, V_{OUT1} = 3.3V, I_{OUT1} = 1A, V_{OUT2} = 5V, I_{OUT2} = 1A, F_{SW} = 1MHz, No Airflow

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	CFF1, CFF2	CAP, 0402 22pF 5% 50V NPO	AVX 04025A220JAT2A
2	2	CIN1, CIN2	CAP, 7343 22µF 20% 35V TANT	AVX TPSY226M035R0200
3	2	C1, C2	CAP, 1206 47µF 20% 16V X5R	TDK C3216X5R1C476M160AB
4	2	C5, C6	CAP, 1206 10µF 20% 25V X5R	TDK C3216X5R1E106M
5	1	C7	CAP, 0402 1µF 20% 10V X5R	TDK C1005X5R1A105M
6	1	L1	IND, 3.3µH 20%	COILCRAFT XFL4020-332MEC
7	1	L2	IND, 4.7µH 20%	COILCRAFT XFL4020-472MEC
8	2	RPG1, RPG2	RES, 0402 100kΩ 1% 1/16W	VISHAY CRCW0402100KFKED
9	3	RSET1, R1, RSET2	RES, 0402 619kΩ 1% 1/16W	VISHAY CRCW0402619KFKED
10	2	R2, R12	RES, 0402 309kΩ 1% 1/16W	VISHAY CRCW0402309KFKED
11	1	R3	RES, 0402 196kΩ 1% 1/16W	VISHAY CRCW0402196KFKED
12	2	R4, R13	RES, 0402 137kΩ 1% 1/16W	VISHAY CRCW0402137KFKED
13	1	R6	RES, 0805 0Ω JUMPER	VISHAY CRCW08050000Z0ED
14	2	R7, R8	RES, 0402 0Ω JUMPER	VISHAY CRCW04020000Z0ED
15	1	R11	RES, 0402 412kΩ 1% 1/16W	VISHAY CRCW0402412KFKED
16	1	R14	RES, 0402 84.5kΩ 1% 1/16W	VISHAY CRCW040284K5FKED
17	1	U1	IC, DUAL SYNCHRONOUS STEP-DOWN CONVERTER	LINEAR TECHNOLOGY LTC3622EDE
Additional Demo Board Circuit Components				
1	0	C3, C4	CAP, 0402 OPTION	OPTION
2	0	R5, R15	RES, 0402 OPTION	OPTION
Hardware: For Demo Board Only				
1	12	E1, E2, E3, E4, E5, E6, E7, E8, E9, E10, E11, E12	TURRET	MILL-MAX 2501-2-00-80-00-00-07-0
2	2	JP1, JP2	HEADER, 3PIN, 2mm	SULLINS NRPN031PAEN-RC
3	2	JP3, JP5	HEADER, 3PIN, DBL ROW 2mm	SULLINS NRPN032PAEN-RC
4	1	JP4	HEADER, 2mm DBL ROW (2X2) 4PIN	SULLINS NRPN022PAEN-RC
5	10	JP6, JP7, JP8, JP9, JP10, JP11, JP12, JP13, JP14, JP15	HEADER, 2PIN, 2mm	SULLINS NRPN021PAEN-RC
6	7	XJP1, XJP2, XJP3, XJP4, XJP5, XJP6, XJP13	SHUNT, 2mm	SAMTEC 2SN-BK-G
7	4	MH1, MH2, MH3, MH4	STANDOFF, SNAP ON	KEYSTONE_8831

SCHEMATIC DIAGRAM



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Mailing Address:

Linear Technology

1630 McCarthy Blvd.

Milpitas, CA 95035

Linear Technology Corporation
1630 McCarthy Blvd., Milpitas, CA 95035-7417
(408) 432-1900 • FAX: (408) 434-0507 • www.linear.com

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Телефон: 8 (812) 309-75-97 (многоканальный)
Факс: 8 (812) 320-03-32
Электронная почта: ocean@oceanchips.ru
Web: http://oceanchips.ru/
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А