DEMO CIRCUIT 1601A
QUICK START GUIDE

LTM®4607EV
High Efficiency Poly-Phase Buck-Boost Power Supply

DESCRIPTION

Demonstration circuit DC1601A is a poly-phase power supply featuring the LTM4607 Power module, a complete high efficiency switching mode buck-boost power supply. The DC1601A input voltage range is from 6V to 36V and is capable of delivering high power through paralleled LTM4607 modules. The demo circuit can deliver up to 10A of output current for 2 paralleled modules (DC1601A-A), 15A for 3 paralleled modules (DC1601A-B) and up to 20A for 4 paralleled modules (DC1601A-C). The DC1601A demonstrates that paralleling modules is easy and reliable.

The output voltage for the board is 12V. The rated load current per module is 5A, however current de-rating may be necessary under certain V_{IN}, V_{OUT}, frequency, and thermal conditions. An on-board external clock is provided for synchronization and interleaving of phases to minimize input and output ripple. An internal phase-locked loop allows the LTM4607 to be synchronized to an external clock within the range of 200 kHz to 400 kHz. The LTM4607 default switching frequency on the DC1601A is set to 300 kHz through the on-board LTC6902 clock generator which interleaves the paralleled phases. The frequency and phase separation set by the LTC6902 are resistor programmable.

These features, including the availability of the LTM4607 in a compact thermally enhanced 15mmx15mmx2.8mm LGA package make the demonstration circuit ideal for use in high-density point of load regulation applications.

Design files for this circuit board are available. Call the LTC Factory.

Table 1. Performance Summary

PARAMETER	CONDITIONS / NOTES	VALUE
Maximum Input Voltage		36V
Minimum Input Voltage		6V
Output Voltage V_{OUT}	Programmed by R22	12V
Maximum Continuous Output Current $I_{OUT\ MAX}$	Current de-rating may be necessary for certain V_{IN}, V_{OUT}, frequency and thermal conditions.	$10A_{DC}$ (DC1601A-A) $15A_{DC}$ (DC1601A-B) $20A_{DC}$ (DC1601A-C)
Default Operating Frequency		300kHz
External Clock Sync. frequency range		200kHz – 400kHz
Output voltage ripple (typical)	V_{OUT} = 12V 300kHz (20MHz BW)	V_{IN} = 9V, I_{OUT} = 10A (DC1601A-A), See Fig. 5a V_{IN} = 12V, I_{OUT} = 15A (DC1601A-B), See Fig. 5b V_{IN}=32V, I_{OUT}=20A (DC1601A-B), See Fig. 5c
Efficiency	V_{IN} = 9V, V_{OUT} = 12V 300kHz	95.7% @ I_{OUT} = 10A (DC1601A-A), See Fig. 2a 94.8% @ I_{OUT} = 15A (DC1601A-B), See Fig. 2b 94.8% @ I_{OUT} = 20A (DC1601A-C), See Fig. 2c
Load Transient	V_{OUT} = 12V 300kHz (20MHz BW)	V_{IN} = 9V, I_{OUT} = 10A (DC1601A-A), See Fig. 4a V_{IN} = 12V, I_{OUT} = 15A (DC1601A-B), See Fig. 4b V_{IN}=32V, I_{OUT}=20A (DC1601A-B), See Fig. 4c

QUICK START PROCEDURE

Demonstration circuit DC1601A is easy to set up to evaluate the performance of paralleled LTM4607 modules. Please refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. 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 to be 0V. Place jumpers in the following positions for a typical $12V_{OUT}$ application:

JP2	*JP1*	*JP3*
MODE	**RUN**	**START**
CCM	OFF	SSO

2. Turn on the power at the input. Increase V_{IN} to 18V (Do not hot-plug the input supply or apply more than the rated maximum voltage of 36V to the board or the modules may be damaged).
3. Set the run pin jumper (JP1) to the ON position. The output voltage should be regulated. The output voltage meter should read 12V±2% (11.76V-12.24V).
4. Vary the input voltage from 6V-36V and adjust the load current from 0-10A (for DC1601A-A), 0-15A (for DC1601A-B), 0-20A (for DC1601A-C). V_{OUT} should remain regulated at 12V±2% (11.76V-12.24V). Observe the load regulation, efficiency and other parameters.
5. Set the load current to 0A. Set the RUN pin jumper (JP1) to the OFF position. Turn off input supply before disconnecting the circuit.

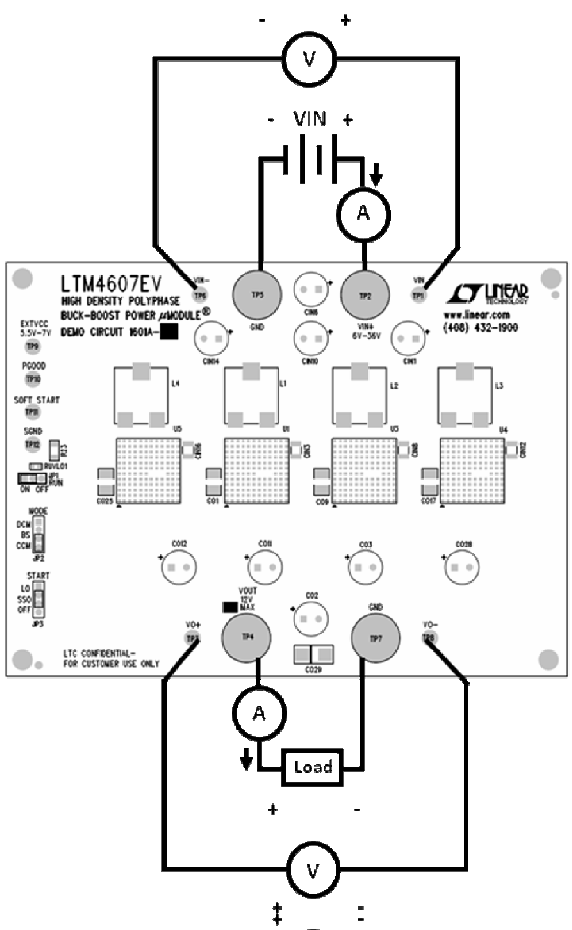

Figure 1.

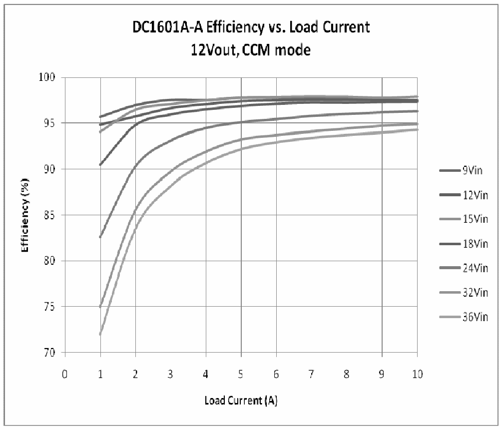

Figure 2a: Measured Efficiency at 12V$_{OUT}$, 300 kHz (DC1601A-A)

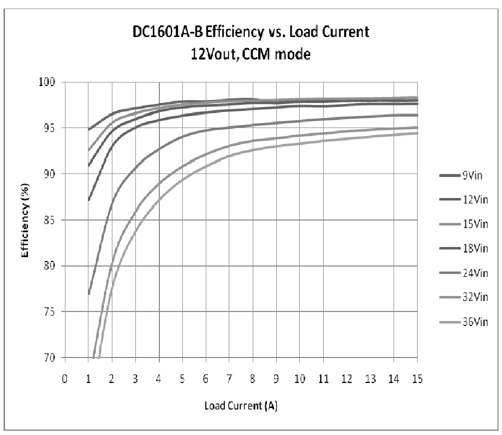

Figure 2b: Measured Efficiency at 12V$_{OUT}$, 300 kHz (DC1601A-B)

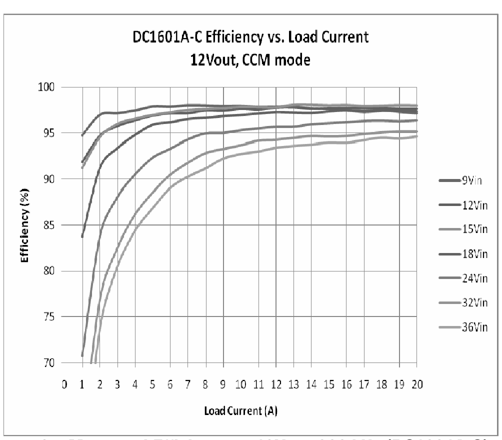

Figure 2c: Measured Efficiency at 12V$_{OUT}$, 300 kHz (DC1601A-C)

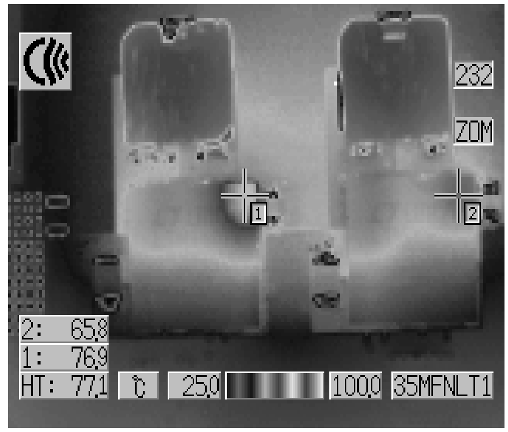

Figure 3a: Thermal capture at 6V$_{IN}$, 12V$_{OUT}$,, 10A, 300kHz (DC1601A-A)

No Forced Airflow (Convection)

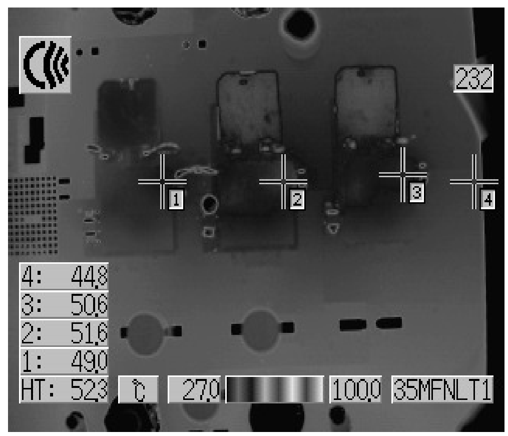

Figure 3b: Thermal capture at 12V$_{IN}$, 12V$_{OUT}$,, 15A, 300kHz (DC1601A-B)

No Forced Airflow (Convection)

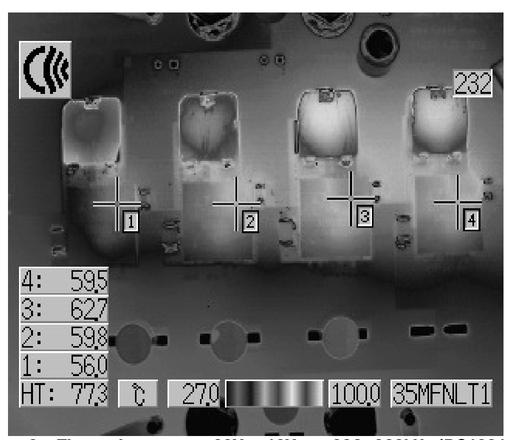

Figure 3c: Thermal capture at 32V$_{IN}$, 12V$_{OUT}$,, 20A, 300kHz (DC1601A-C)

No Forced Airflow (Convection)

DC1601A-A: V_{IN} = 9V, V_{OUT} = 12V, I_{OUT}DC = 5A,
I_{OUT}Step = 5A, f_{SW} = 300 kHz

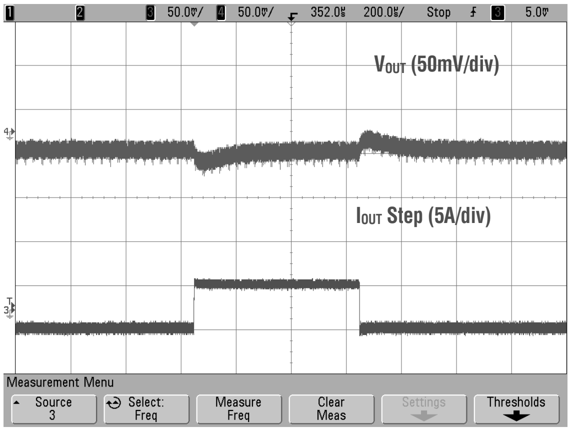

Figure 4a. Measured Load Step Response (DC1601A-A)

DC1601A-B: V_{IN} = 12V, V_{OUT} = 12V, I_{OUT}DC = 7.5A,
I_{OUT}Step = 7.5A, f_{SW} = 300 kHz

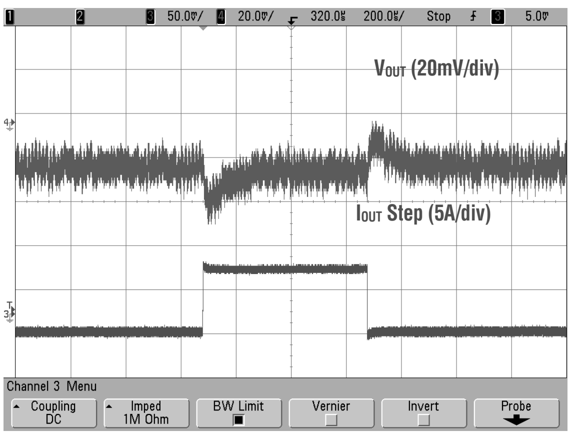

Figure 4b. Measured Load Step Response (DC1601A-B)

DC1601A-C: V_{IN} = 32V, V_{OUT} = 12V, I_{OUT}DC = 10A,
I_{OUT}Step = 7.5A, f_{SW} = 300 kHz

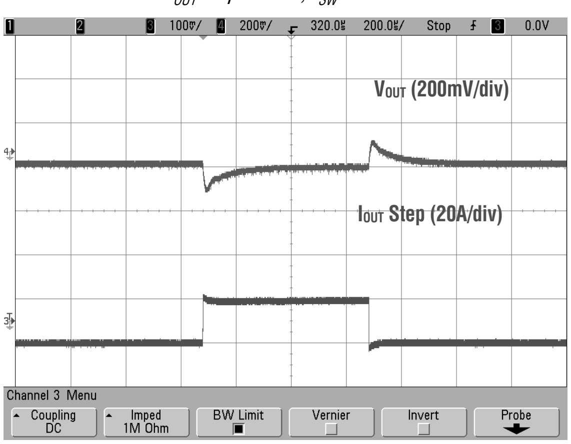

Figure 4c. Measured Load Step Response (DC1601A-C)

DC1601A-A: V_{IN} = 9V, V_{OUT} = 12V, I_{OUT} = 10A,
f_{SW} = 300 kHz

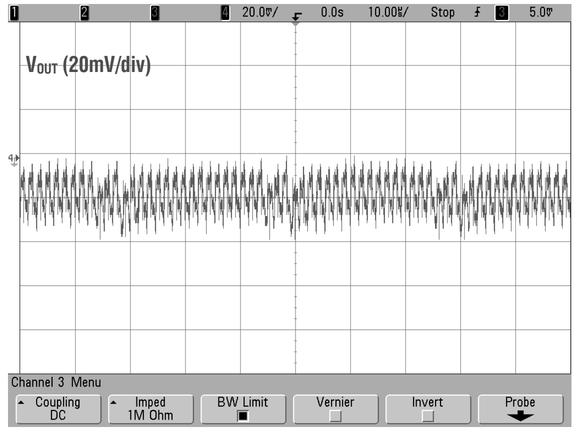

Figure 5a: Measured Output Voltage Ripple (DC1601A-A)

DC1601A-A: V_{IN} = 12V, V_{OUT} = 12V, I_{OUT} = 15A,
f_{SW} = 300 kHz

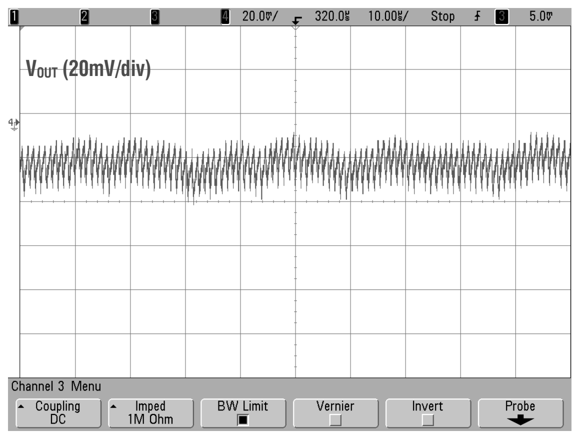

Figure 5b: Measured Output Voltage Ripple (DC1601A-B)

DC1601A-C: V_{IN} = 32V, V_{OUT} = 12V, I_{OUT} = 20A,
f_{SW} = 300 kHz

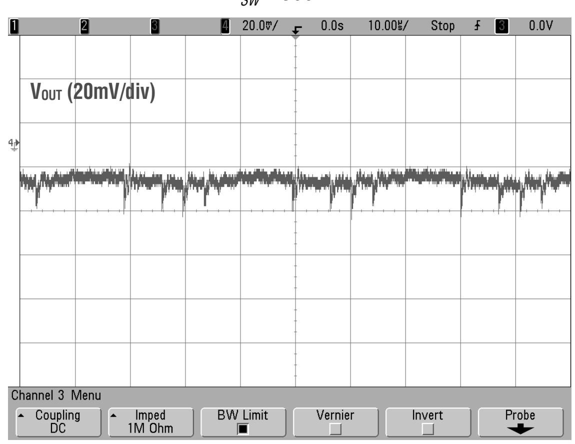

Figure 5c: Measured Output Voltage Ripple (DC1601A-C)

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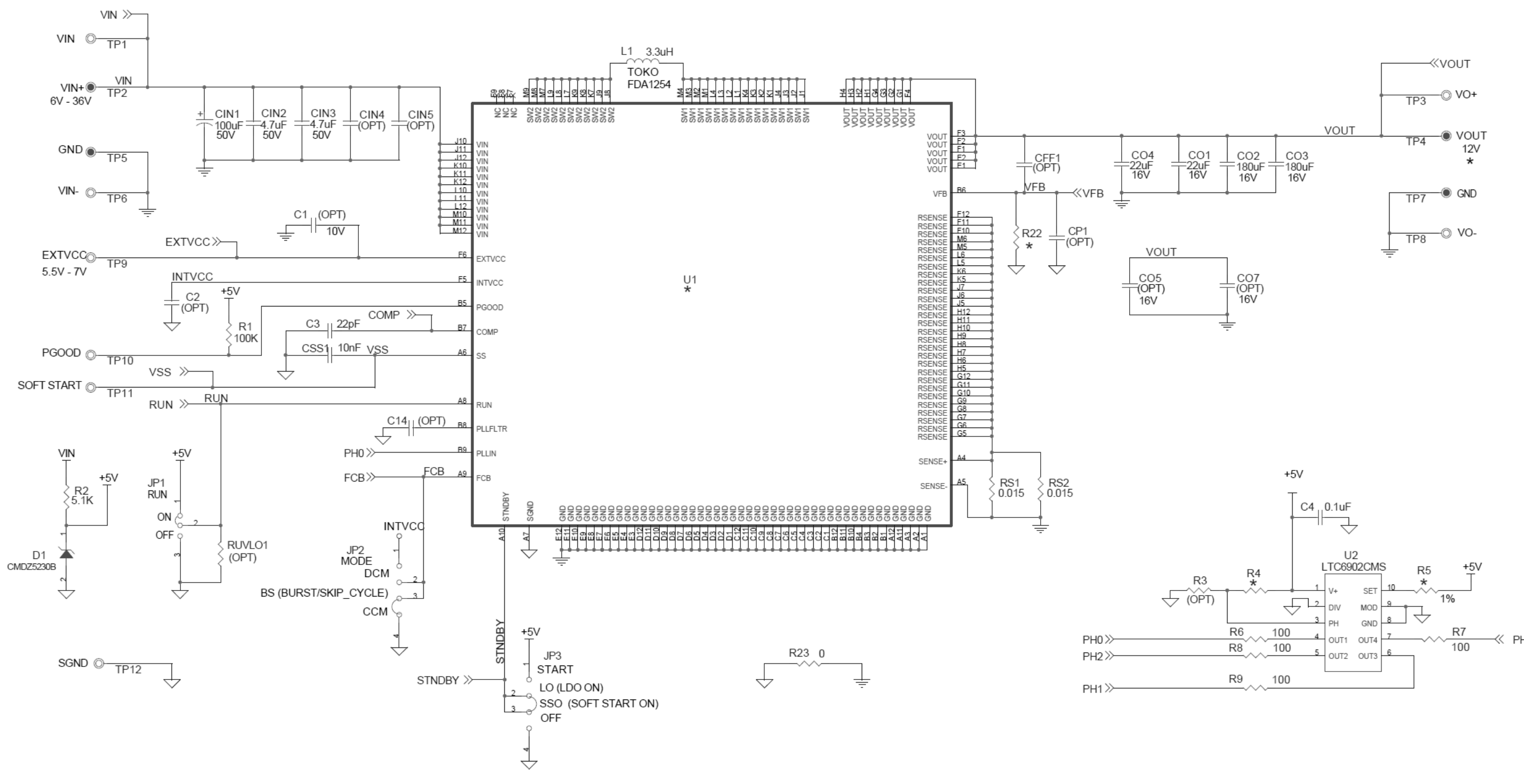

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ASSY	U1	U3	U4	U5	VOUT	CIN1 - CIN12	CIN15 - CIN16	CO17 - CO18	CO25 - CO26	C8	C10	L3	L4	R4	R5	R14 - R17	R18 - R21	R22	RS5-RS6	RS7-RS8	RS8
DC1601A-A	LTM4607EV	LTM4607EV	—	—	10A MAX	OPT	OPT	OPT	OPT	OPT	OPT	OPT	OPT	0	154K	OPT	OPT	3.57K	OPT	OPT	OPT
DC1601A-B	LTM4607EV	LTM4607EV	LTM4607EV	—	15A MAX	4.7uF	OPT	22uF	OPT	22pF	OPT	3.3uH	OPT	OPT	205K	0	OPT	2.37K	0.015	OPT	OPT
DC1601A-C	LTM4607EV	LTM4607EV	LTM4607EV	LTM4607EV	20A MAX	4.7uF	4.7uF	22uF	22uF	22pF	22pF	3.3uH	3.3uH	0	154K	0	0	1.78K	0.015	0.015	0.015

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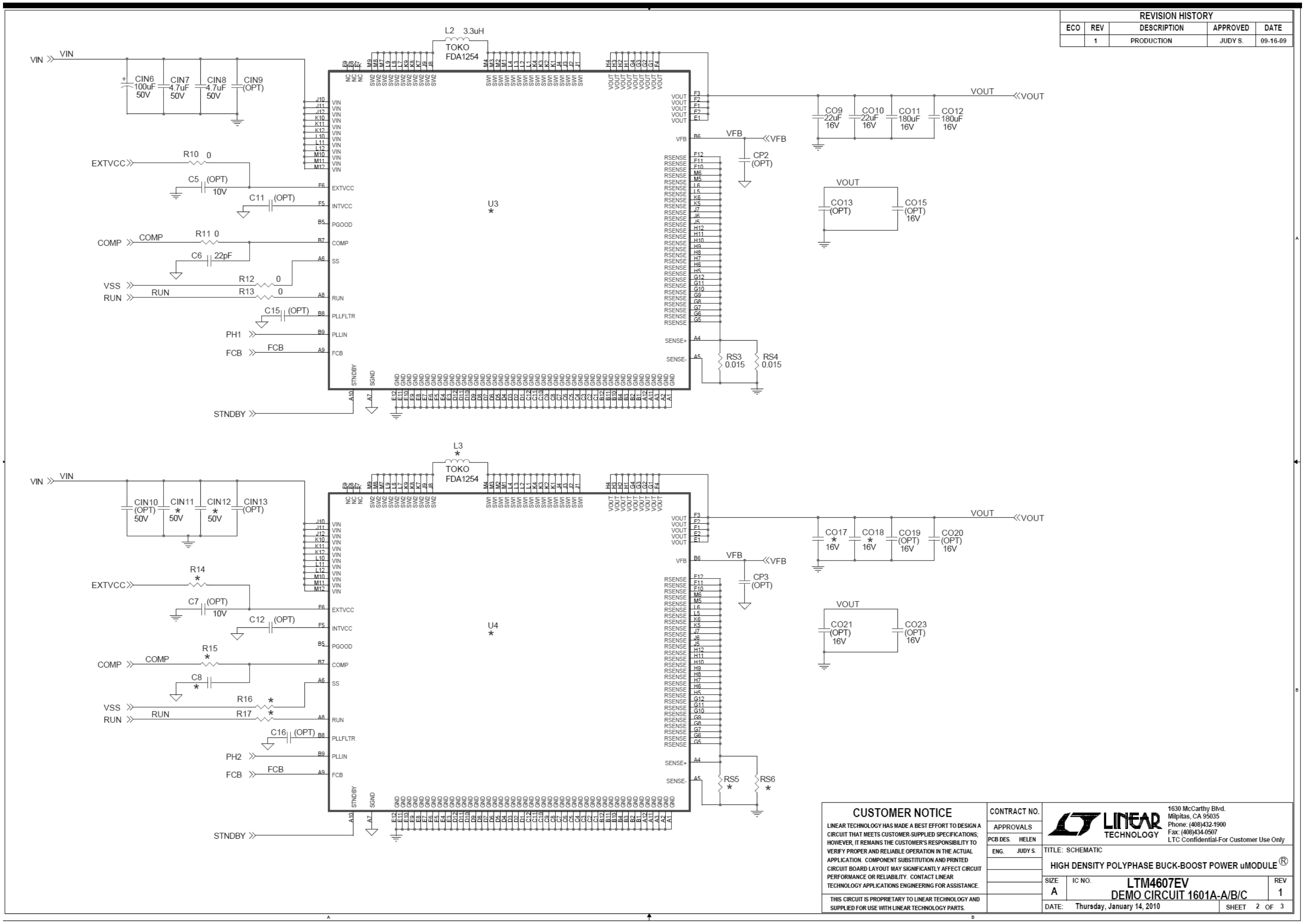
HIGH DENSITY POLYPHASE BUCK-BOOST POWER uMODULE®

SIZE A | IC NO. LTM4607EV DEMO CIRCUIT 1601A-A/B/C | REV 1

DATE: Thursday, January 14, 2010 | SHEET 1 OF 3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U4
L2 3.3uH TOKO FDA1254
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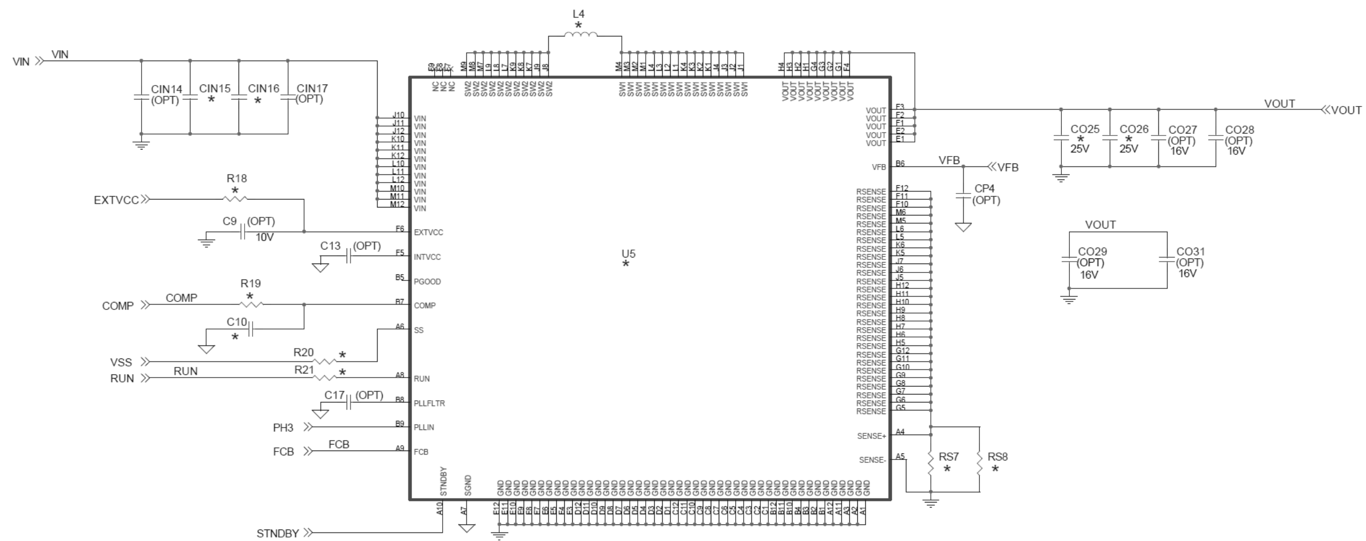

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