LT3514

Triple Step-Down Switching Regulator with 100% Duty Cycle Operation

DESCRIPTION

Demonstration circuit 1980A is a triple current mode PWM step-down DC/DC converter featuring the LT®3514. The demo circuit is designed for 5V, 3.3V and 1.8V outputs from a 5.4V to 36V input. The current capability of 5V and 1.8V outputs is 1A and the 3.3V output is capable of 2A output. Individual soft-start and current limit for each output as well as frequency synchronous function simplify the complex design of triple-output power converters.

Each converter is synchronized to either a common external clock input or a resistor programmable 250kHz to 2.2MHz internal oscillator. Programmable frequency allows optimization between efficiency and external component size. Each output can be independently disabled using its own RUN/SS pin.

The LT3514 data sheet gives complete description of the device, operation and application information. The data sheet must be read in conjunction with this quick start guide for the demo circuit 1980A.

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

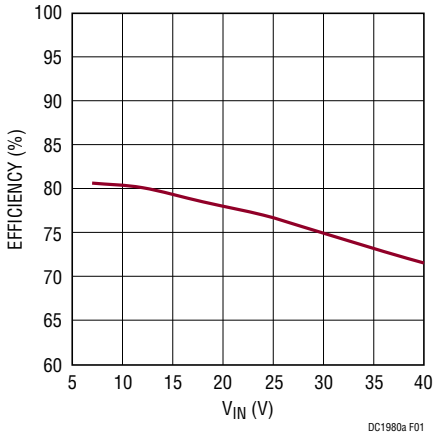


Figure 1. System Efficiency at f = 1MHz with I_{OUT1} = I_{OUT4} = 1A and I_{OUT3} = 2A

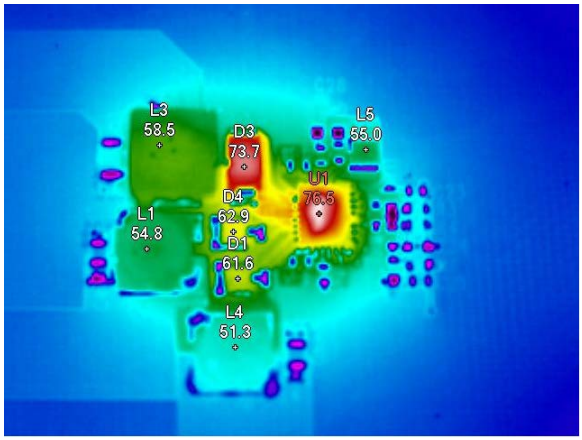


Figure 2. Thermal Image at V_{IN} = 12V, f = 1MHz with I_{OUT1} = I_{OUT4} = 1A and I_{OUT3} = 2A

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN}	Input Supply Range		5.4		36	V
V_{OUT1}	Output Voltage 1		4.85	5	5.15	V
V_{OUT3}	Output Voltage 3		3.2	3.3	3.4	V
V_{OUT4}	Output Voltage 4		1.746	1.8	1.854	V
Frequency	Switching Frequency	V_{IN} = 12V	0.9	1	1.1	MHz
I_{OUT1}	V_{OUT1} Maximum Output Current	V_{IN} = 5.4V ~ 36V	1			A

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
I_{OUT3}	V_{OUT3} Maximum Output Current	V_{IN} = 5.4V ~ 36V	2			A
I_{OUT4}	V_{OUT4} Maximum Output Current	V_{IN} = 5.4V ~ 36V	1			A
VOUT1(AC)	VOUT1 Output Ripple	VIN = 5.4V ~ 36V, I_{OUT1} = 1A			25	mV
VOUT3(AC)	VOUT3 Output Ripple	VIN = 5.4V ~ 36V, I_{OUT3} = 2A			25	mV
VOUT4(AC)	VOUT4 Output Ripple	VIN = 5.4V ~ 36V, I_{OUT4} = 1A			25	mV

QUICK START PROCEDURE

Demonstration circuit 1980A is easy to set up to evaluate the performance of the LT3514. Refer to Figure 3 for proper measurement equipment setup and follow the procedure below:

NOTE. When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the input or output voltage ripple by touching the probe tip directly across the VIN or VOUT and GND terminals. See Figure 4 for proper scope probe technique.

1. Place JP1 to JP4 on ON position.
2. With power off, connect the input power supply to VIN and GND.
3. Turn on the power at the input.

   NOTE. Make sure that the input voltage does not exceed 36V

4. Check for the proper output voltages.

   NOTE. If there is no output, temporarily disconnect the load to make sure that the load is not set too high.

5. Once the proper output voltages are established, adjust the load within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters.

QUICK START PROCEDURE

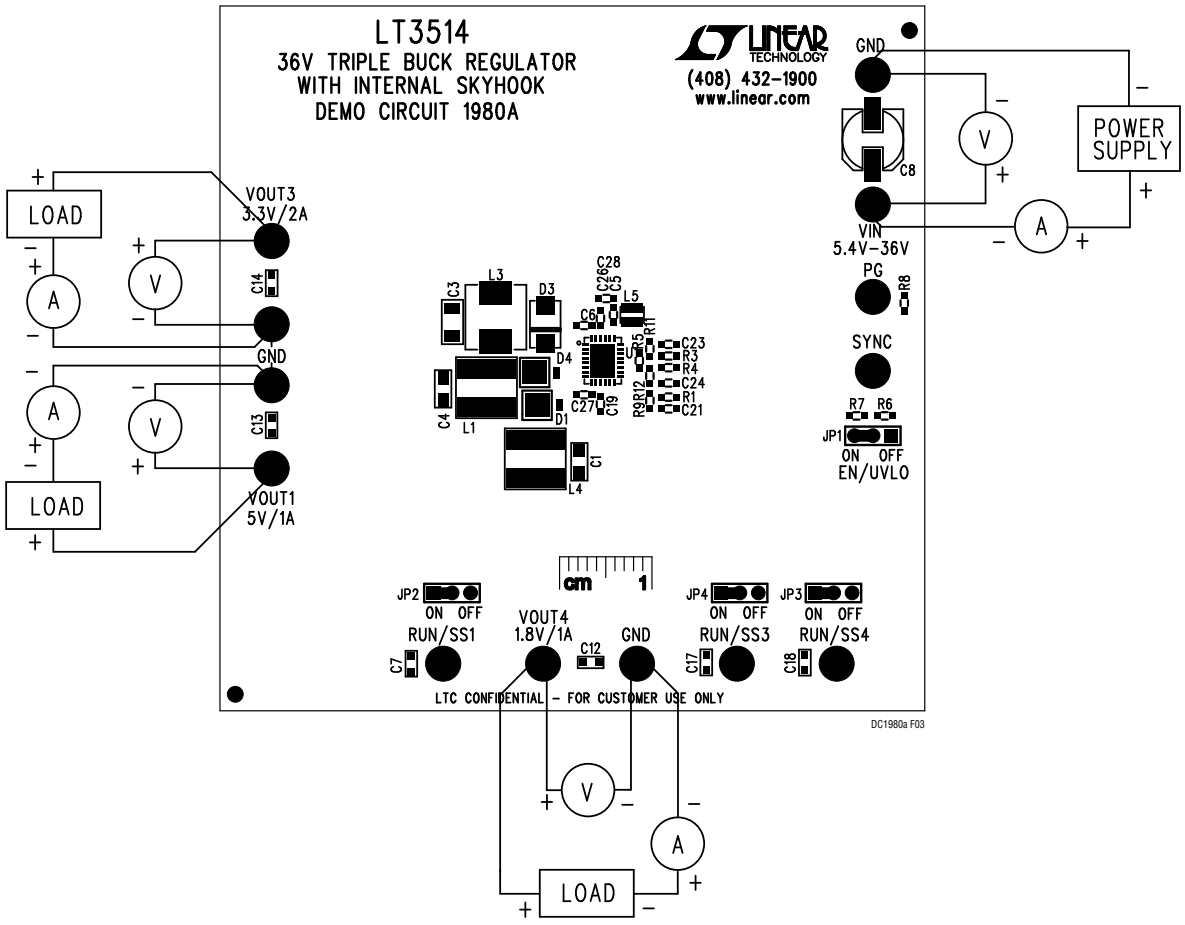


Figure 3. DC1980A Proper Equipment Setup

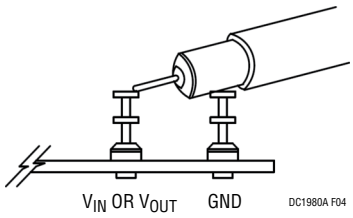
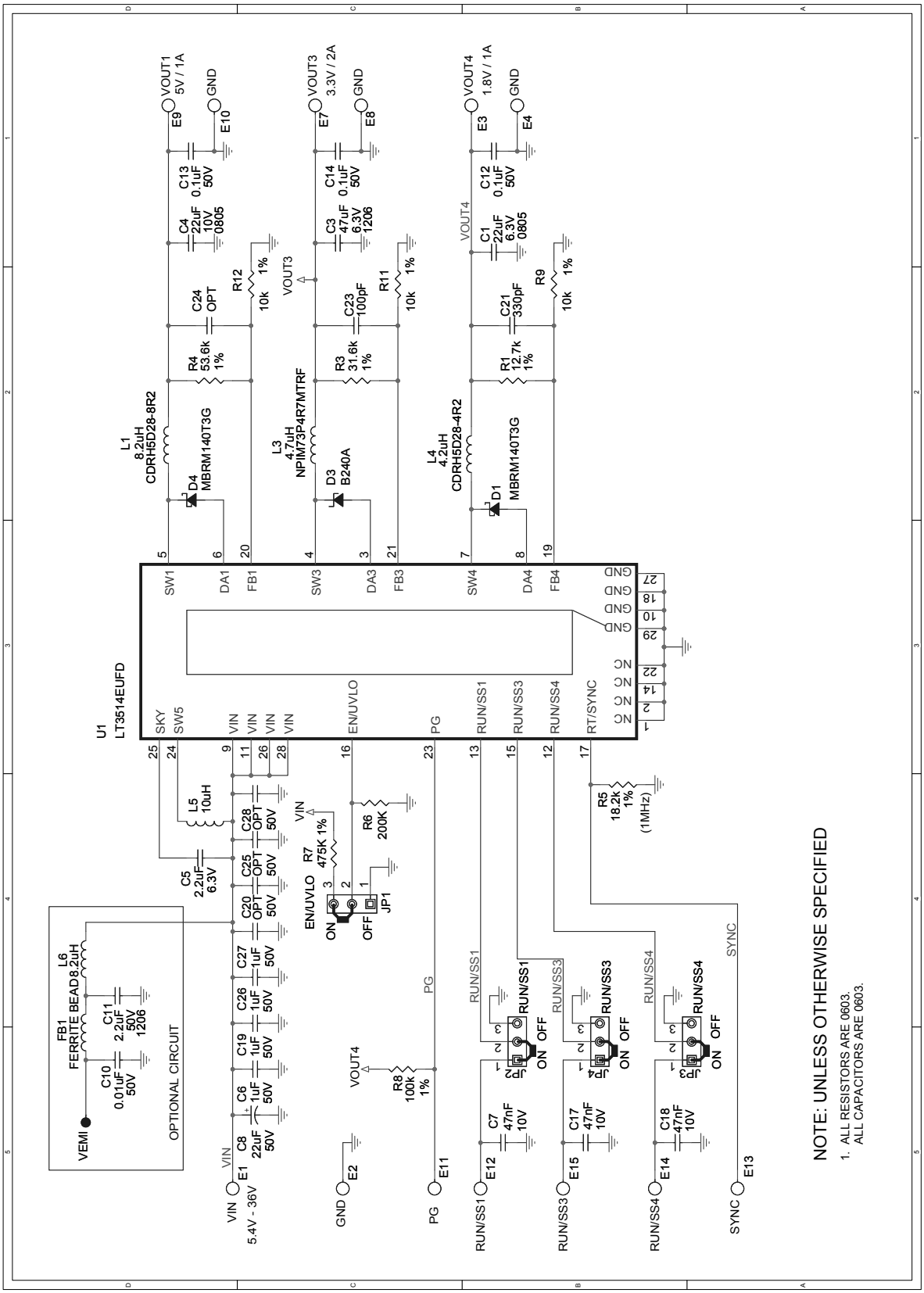


Figure 4. Measuring Input or Output Ripple

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP, X5R, 22µF, 6.3V, 10% 0805	TDK, C2012X5R0J226K
2	1	C3	CAP, X5R, 47µF, 6.3V, 10% 1206	MURATA, GRM31CR60J476KE19L
3	1	C4	CAP, X5R, 22µF, 10V, 10% 0805	TDK, C2012X5R1A226K
4	1	C5	CAP, X5R, 2.2µF, 6.3V, 10% 0603	TDK, C1608X5R0J225K
5	4	C6, C19, C26, C27	CAP, X5R, 1µF, 50V, 10% 0603	TDK, C1608X5R1H105K
6	3	C7, C17, C18	CAP, X7R, 47nF, 10V, 10% 0603	AVX, 0603ZC473KAT2A
7	1	C21	CAP, NP0, 330pF, 50V, 5% 0603	AVX 06035A331JAT2A
8	1	C23	CAP, NP0, 100pF, 50V, 5% 0603	AVX 06035A101JAT
9	2	D1, D4	DIODE, SCHOTTKY BARRIER RECTIFIER	ON SEMI, MBRM140T3G
10	1	D3	SCHOTTKY RECTIFIER, SMA	VISHAY, B240A-M3
11	1	L1	IND, 8.2µH	SUMIDA, CDRH5D28NP-8R2NC
12	1	L3	IND, 4.7µH	NIC, NPIM73P4R7MTRF
13	1	L4	IND, 4.2µH	SUMIDA, CDRH5D28NP-4R2NC
14	1	L5	IND, 10µH	COILCRAFT, XPL2010-103MLB
15	1	R1	RES, CHIP, 12.7k, 1% 1/16W, 0603	VISHAY, CRCW060312K7FKED
16	1	R3	RES, CHIP, 31.6k, 1% 1/16W, 0603	VISHAY, CRCW060331K6FKED
17	1	R4	RES, CHIP, 53.6k, 1%, 1/16W, 0603	VISHAY, CRCW060353K6FKED
18	1	R5	RES, CHIP, 18.2k, 1% 1/16W, 0603	VISHAY, CRCW060318K2FKED
19	1	R6	RES, CHIP, 200k, 5% 1/16W, 0603	VISHAY, CRCW0603200KJNED
20	1	R7	RES, CHIP, 475k, 1% 1/16W, 0603	VISHAY, CRCW0603475KFKED
21	1	R8	RES, CHIP, 100k, 1% 1/16W, 0603	VISHAY, CRCW0603100KFKED
22	3	R9, R11, R12	RES, CHIP, 10k, 1% 1/16W, 0603	VISHAY, CRCW060310K0FKED
23	1	U1	IC, 36V TRIPLE BUCK REGULATOR	LINEAR TECHNOLOGY, LT3514EUFD#PBF
Additional Demo Board Circuit Components				
1	1	C8	CAP, ALUM, 22µF, 50V, 20%	SUN ELECT, 50CE22BS
2	0	C10 (OPT)	CAP, X7R, 0.01µF, 50V,10% 0603	TDK, C1608X7R1H103K OPTION
3	0	C11 (OPT)	CAP, X7R, 2.2µF, 50V, 10% 1206	MURATA, GCM31CR71H225KA55L
4	3	C12 TO C14	CAP, X7R, 0.1µF, 50V, 10% 0603	MURATA, GRM188R71H104KA93D
5	0	C20, C25, C28 (OPT)	CAP, X7R, 0.1µF, 50V, 10% 0603	MURATA, GRM188R71H104KA93D
6	0	C24 (OPT)	CAP, 0603	
7	0	FB1 (OPT)	FERRITE BEAD, OPTION	OPTION
8	0	L6 (OPT)	IND, 8.2µH OPTION	VISHAY, IHLP-2525CZ-01 OPTION
Hardware: For Demo Board Only				
1	15	E1 TO E15	TURRET	MILL MAX, 2501-2-00-80-00-00-07-0
2	4	JP1 TO JP4	HEADER, 3PIN, 2mm	SAMTEC, TMM-103-02-L-S
3	4	xJP1 TO xJP4	SHUNT, 2mm	SAMTEC, 2SN-BK-G

SCHEMATIC DIAGRAM



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This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

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