LTC7150SEY
High Efficiency 20A Synchronous Buck Regulator

DESCRIPTION

Demonstration circuit 2411A is a high efficiency synchronous buck regulator with a 3.1V to 20V input range. It can supply 20A maximum load current at 1.2V output. The demo board features the LTC®7150S regulator. No external MOSFETs nor external current sense resistor are required. It uses a phase-lockable controlled on-time constant-frequency, current mode architecture, ideal for high step-down ratio applications. The operating frequency is programmable from 400kHz to 3MHz with an external resistor (R5). The LTC7150S is housed in a 6mm × 5mm × 1.3mm 42-Lead BGA package.

The light load operation mode of the converter is determined with the Mode/Sync pin. Use the JP3 jumper to select discontinuous mode (DCM), forced continuous mode (CCM), or to synchronize to an external clock. Multiple LTC7150S regulators can be paralleled for multiphase operation to provide more than 20A of current (JP2: 1-PH, for standard single phase operation). To shut down the converter, one simple way is to force the RUN pin below 1.15V (JP1: OFF). The power good output (PGOOD terminal) is low when the output voltage is outside of the ±7.5% regulation window.

The LTC7150S data sheet gives a complete description of the operation and application information. The data sheet must be read in conjunction with this demo manual.

Design files for this circuit board are available at http://www.linear.com/demo/DC2411A

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITION	VALUE
Input Voltage Range		3.1V to 20V
Output Voltage	V_{IN} = 3.1V to 20V, I_{OUT} = 0A to 20A	1.2V ± 2%
Maximum Output Current	V_{IN} = 3.1V to 20V, V_{OUT} = 1.2V	20A
Typical Switching Frequency		400kHz
Typical Efficiency	V_{IN} = 12V, I_{OUT} = 20A	88.5%
Typical Output Voltage Ripple	V_{IN} = 12V, I_{OUT} = 20A	25mV_{P-P}

QUICK START PROCEDURE

Demonstration circuit 2411A is easy to set up to evaluate the performance of the LTC7150S. Refer to Figure 1 for the proper measurement equipment setup and follow the procedure below:

1. With power off, connect the input power supply to V_{IN} (3.1V to 20V) and GND (input return).
2. Connect the 1.2V output load between V_{OUT} and GND (Initial load: no load).
3. Connect the DVMs to the input and outputs.
4. Turn on the input power supply and check for the proper output voltages. V_{OUT} should be 1.2V ± 2%.
5. Once the proper output voltages are established, adjust the loads within the operating range and observe the output voltage regulation, ripple voltage and other parameters.

Note: When measuring the output or input voltage ripple, 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.

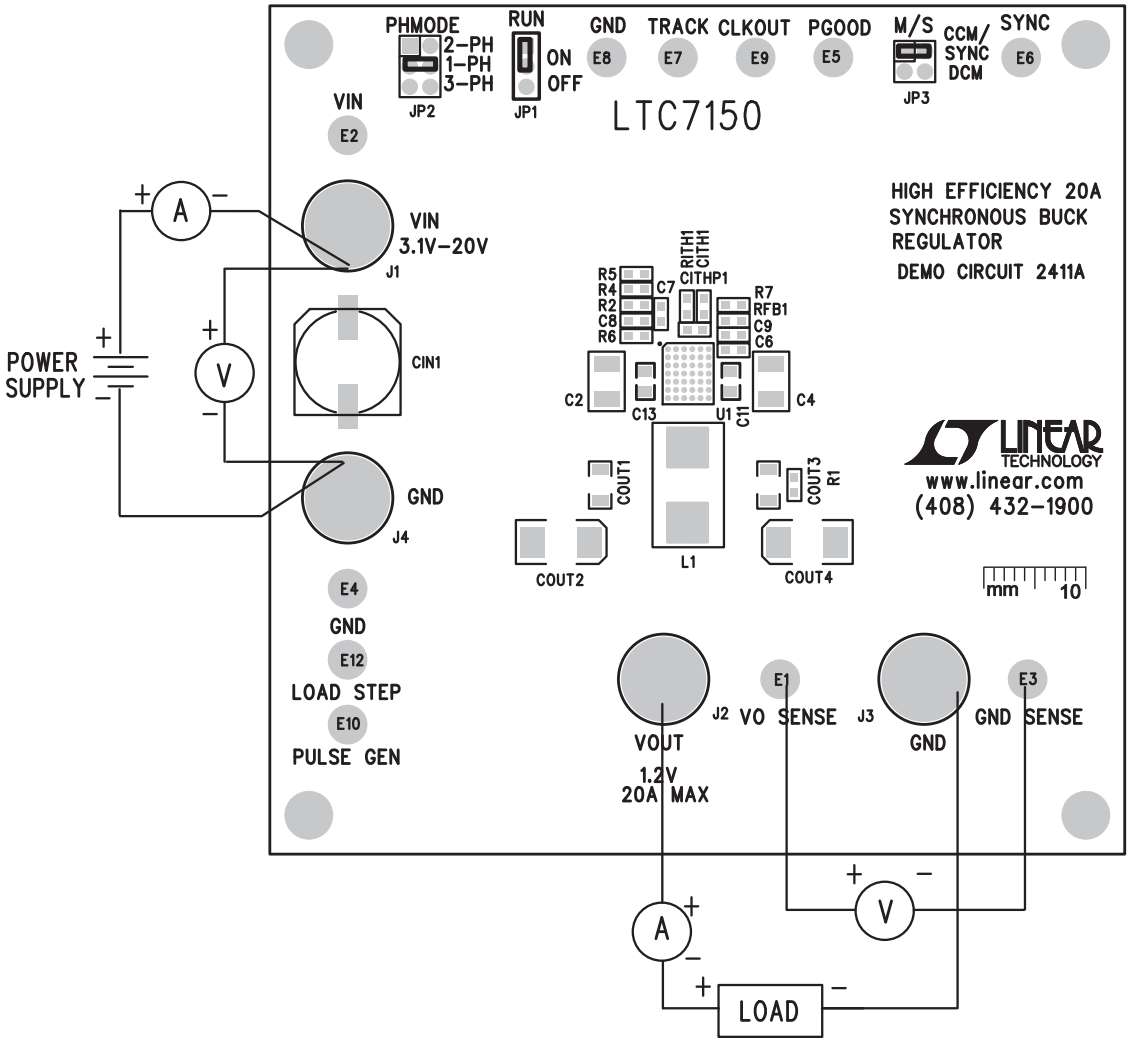


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

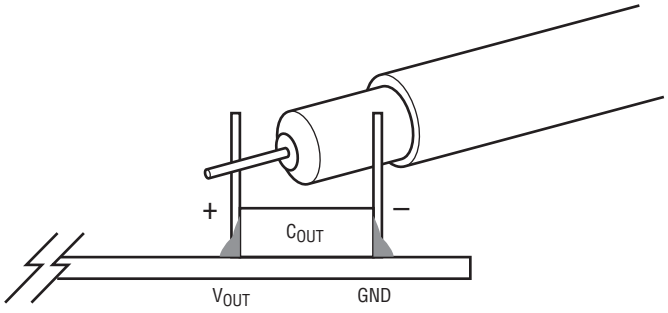


Figure 2. Measuring Output Voltage Ripple

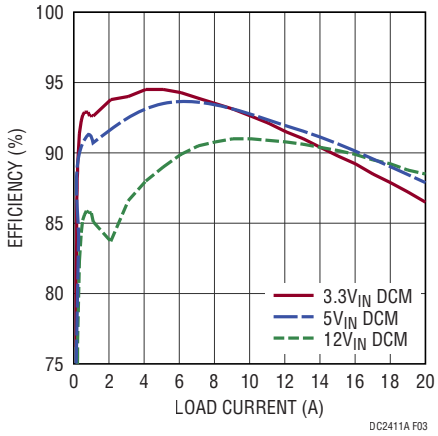


Figure 3. Efficiency vs Load Current (V_O = 1.2V, 400kHz)

QUICK START PROCEDURE

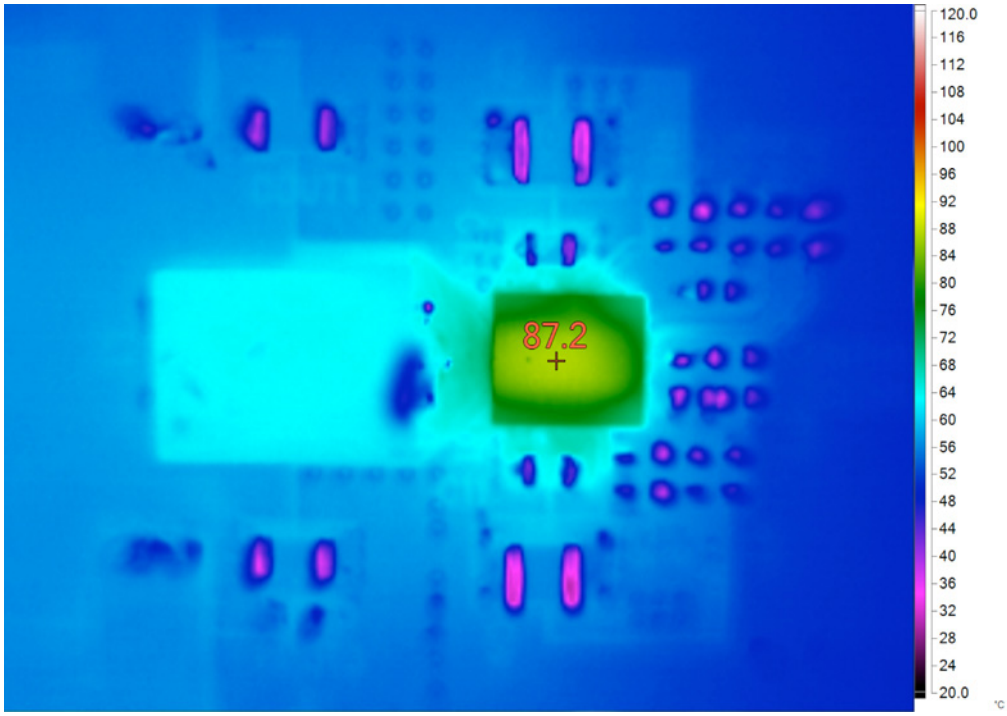


Figure 4. Thermal Picture (V_{IN} = 12V, I_O = 20A. 21°C Ambient, No Forced Airflow)

QUICK START PROCEDURE

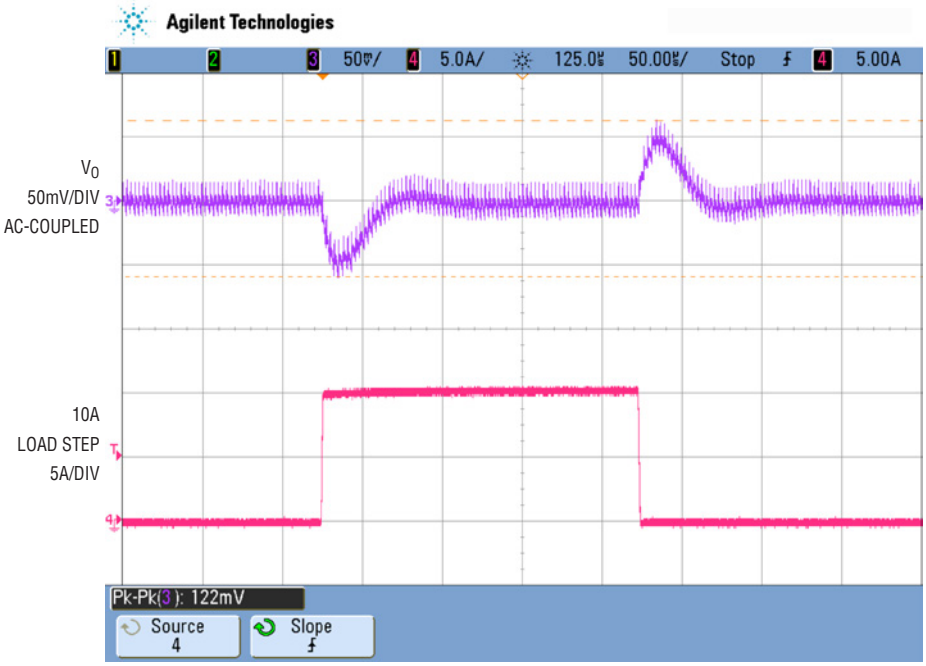
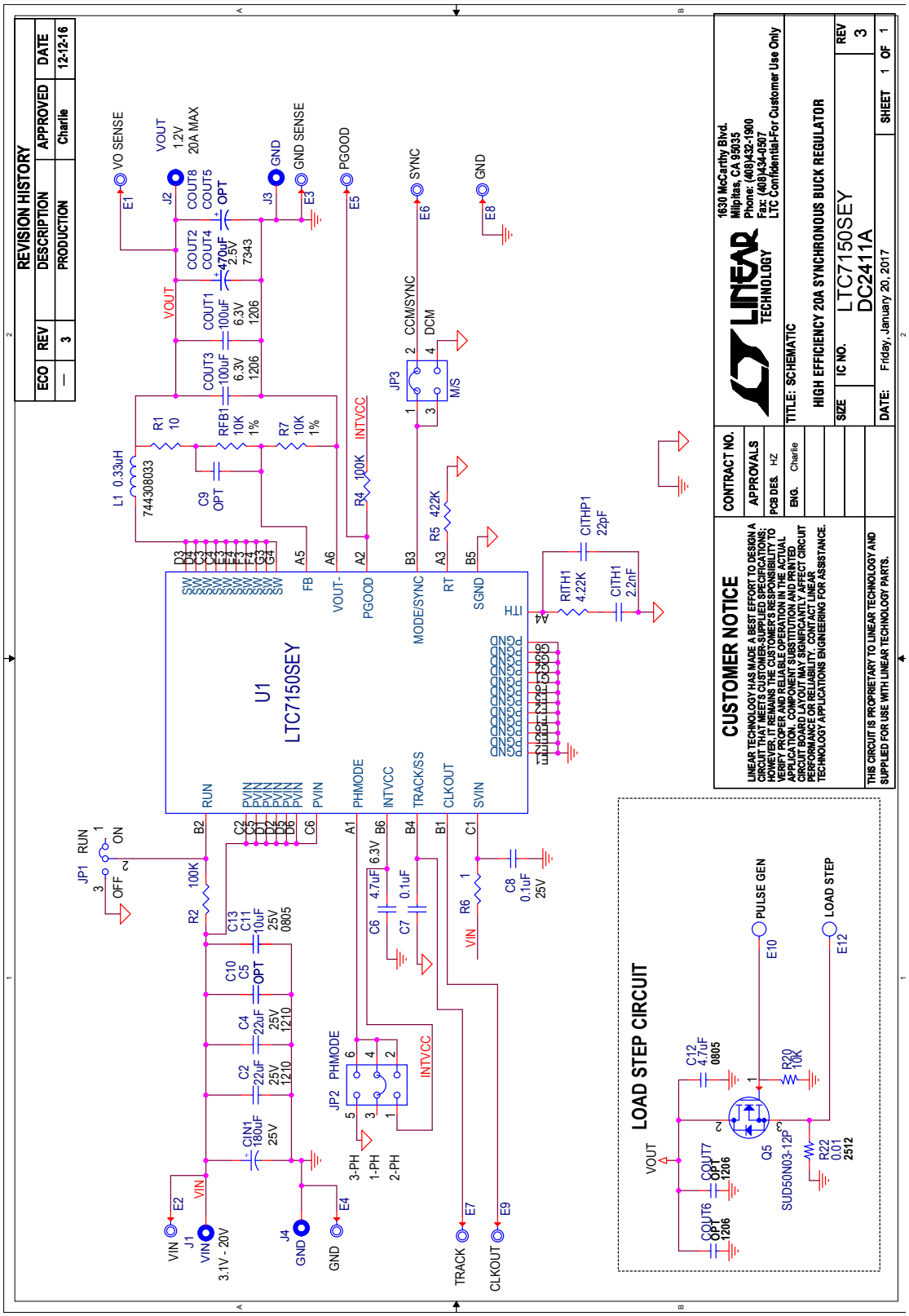


Figure 5. Load Step Transient Test (V_{IN} = 12V, Total I_O: 10A to/from 20A)

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	CIN1	CAP, ALUM ELEC 180µF 20% 25V	PANASONIC., 25SVPF180M
2	1	CITHP1	CAP, 0603 22pF 5% 50V COG	AVX, 06035A220JAT2A
3	1	CITH1	CAP, 0603 2200pF 5% 50V COG	AVX, 06035A222JAT2A
4	2	COUT1, COUT3	CAP, 1206 100µF 20% 6.3V X5R	AVX, 12066D107MAT2A
5	2	COUT2, COUT4	CAP, 7343, 470µF, 2.5V, SP-CAP	PANASONIC, EEFGX0E471R
6	2	C2, C4	CAP, 1210 22µF 20% 25V X5R	AVX, 12103D226MAT2A
7	1	C6	CAP, 0603 4.7µF 20% 6.3V X5R	AVX, 06036D475KAT2A
8	2	C7, C8	CAP, 0603 0.1µF 10% 25V X5R	AVX, 06033D104KAT2A
9	2	C11, C13	CAP, 0805 10µF 20% 25V X5R	AVX, 08053D106MAT2A
10	1	L1	IND, 0.33µH	WURTH ELEKTRONIK, 744308033
11	3	RFB1, R7, R20	RES, 0603 10k 1%	VISHAY, CRCW060310K0FKEA
12	1	RITH1	RES, 0603 4.22k 1%	VISHAY, CRCW06034K22FKEA
13	1	R1	RES, 0603 10Ω 5% 1/10W	VISHAY, CRCW060310R0JNEA
14	1	R6	RES, 0603 1Ω 5% 1/10W	VISHAY, CRCW06031R00JNEA
15	2	R2, R4	RES, 0603 100k 1% 1/10W	VISHAY, CRCW0603100KFKEA
16	1	R5	RES, 0603 422k 1% 1/10W	VISHAY, CRCW0603422KFKEA
17	1	U1	IC, LTC7150SEY#PBF	LINEAR TECH., LTC7150SEY#PBF
Additional Demo Board Circuit Components				
1	0	C5, C9, C10, COUT6, COUT7	OPT	
2	0	C12	CAP, 0805 4.7µF 20% 6.3V X5R	AVX, 08056D475KAT2A
3	0	R22	RES, 2512 0.01Ω 1% 1/2W	VISHAY, WSL2512R0100FEA
4	0	Q5	XSTR, MOSFET, DPAK-TO252AA	VISHAY, SUD50N03-12P-E3
Hardware for Demo Board Only				
1	11	E1-E10, E12	TESTPOINT, TURRET, 0.094" PBF	MILL-MAX, 2501-2-00-80-00-00-07-0
2	1	JP1	HEADER, 3-PIN 0.079 SINGLE ROW	WURTH ELEKTRONIK, 62000311121
3	1	JP2	HEADER, DOUBLE ROW HEADER, 2 × 3 PIN	WURTH ELEKTRONIK, 62000621121
4	1	JP3	HEADER, DOUBLE ROW HEADER, 2 × 2 PIN	WURTH ELEKTRONIK, 62000421121
5	4	J1-J4	JACK, BANANA	KEYSTONE, 575-4
6	3	JP1-JP3	SHUNT, 0.079" CENTER	WURTH ELEKTRONIK, 60800213421
7	4	MH1-MH4	STANDOFF, NYLON, 0.5, 1/2"	WURTH ELEKTRONIK, 702935000
8	1		FAB PRINTED CIRCUIT BOARD	DEMO CIRCUIT 2411A
9	1		STENCIL (TOP)	STENCIL DC2411A

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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