LT3154
5.5V 6A Low-Noise Monolithic Buck-Boost DC/DC Converter

DESCRIPTION

Demonstration circuit 2757A is a 6A buck-boost DC/DC converter featuring the LT®3154, a low noise, low-I_Q monolithic buck-boost converter with programmable soft-start.

The DC2757A demo board has four user-selectable operating modes:

- An accurate programmable EN/UVLO pin, which is used to ENABLE the converter (JP1).
- BURST MODE© and External CLK/Fixed Frequency PWM (JP2).
- Programmable Soft-Start (JP3).
- Selectable (2.2MHz) and Adjustable Switching Frequency RT (500kHz to 4MHz) (JP4).

The LT3154 uses average current mode control to simplify voltage loop compensation and provide good line and load transient response.

The DC2757A operates with a 1.8V to 5.5V input voltage range. The demo board has been designed with the output voltage set to 3.3V. The LT3154 incorporates a proprietary low noise switching algorithm which optimizes efficiency with input voltages above, below, or equal to the output voltage and ensures seamless transitions between operating modes.

In PWM mode, the LT3154 can operate with a switching frequency between 500kHz to 4MHz by programming the RT resistor R4. It also has a selectable switching frequency (2.2MHz) to optimize small size with high efficiency operation. The LT3154 can be synchronized to the External CLK provided RT is programmed 25%-50% below the synchronization frequency.

The LT3154 has a Soft-Start feature and can be programmed with the soft-start capacitor C13 (EXT SS). It also has a selectable internal soft-start (INT SS) of 2.2ms.

Figure 2 shows typical demo board efficiency. Figure 3 and Figure 4 show the load step response.

The LT3154 data sheet has detailed information about the operation, specifications, and applications of the part. The data sheet should be read in conjunction with this Quick Start Guide.

Design files for this circuit board are available.

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage V_{IN} Range	Operating	1.8		5.5	V
Switching Frequency (f_{SW})	RT (R4 = 34kΩ) Internal		3.2 2.2		MHz
Output Voltage V_{OUT}	R5 = 1MΩ R6 = 432kΩ		3.3		V
Output Current I_{OUT}	V_{IN} > 3.3V		5A		
Efficiency			See Figure 2		%

Note: Demo board output current is a function of input voltage. Refer to the data sheet for more information.

QUICK START PROCEDURE

Using short twisted pair leads for any power connections and with all loads and power supplies off, See Figure 1 for the proper measurement and equipment setup. The power supply (PS1) should not be connected to the circuit until told to do so in the procedure below.

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 V_{IN} or V_{OUT} and GND terminals, or by using an oscilloscope probe tip jack.

1. Jumper and PS1 settings to start:

   PS1 = OFF

   LOAD = OFF

   JP1 (EN) = ON

   JP2 (MODE) = FIXED FREQ

   JP3 (SS) = INT SS

   JP4 (RT) = 2.2MHz

2. With power OFF, connect the power supply (PS1) as shown in Figure 1. If accurate current measurements are desired (for efficiency calculations for example), connect an ammeter in series with the supply as shown. The ammeter is not required, however.

3. Turn on PS1 and slowly increase the voltage until the voltage at V_{IN} is 4.5V.

4. Verify V_{OUT} is ~3.3V.

5. Connect a 5A load to V_{OUT} as shown in Figure 1 (0.66Ω for V_{OUT} = 3.3V). Connect an ammeter if accurate current measurement or monitoring is desired.

6. V_{IN} can now be varied between 1.8V and 5.5V. I_{OUT} needs to be reduced for $V_{IN} < V_{OUT}$ to ensure V_{OUT} remains in regulation.

7. Load current (I_{OUT}) can also be varied. The maximum I_{OUT} is a function of V_{IN} and the current limit. Consult the data sheet for more information on I_{OUT} vs V_{IN}. For $V_{IN} > V_{OUT}$, I_{OUT} can be increased to 5A. For $V_{IN} <$ 3.3V, the maximum I_{OUT} is reduced.

NOTE: If V_{OUT} drops out of regulation, check to be sure the maximum load has not been exceeded, or that V_{IN} is not below the minimum value (1.8V).

8. For operation in BURST Mode, move Jumper JP2 to BURST. Refer to the data sheet for more information.

9. For the programmable switching frequency, move Jumper JP4 to RT (3.2MHz), else it will default to a switching frequency of 2.2MHz.

10. For the programmable Soft-Start feature, move JP3 to EXT SS, else it will have a default Soft-Start of approx. 2.2ms.

QUICK START PROCEDURE

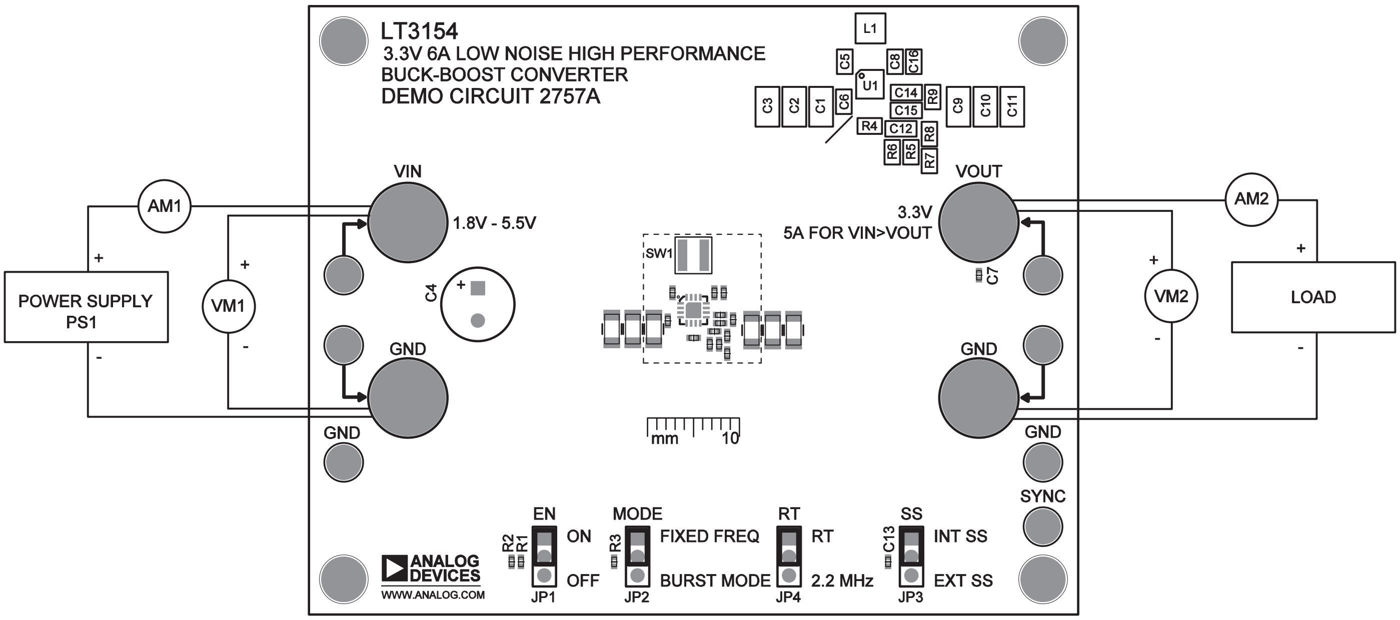

Figure 1. Test Procedure Setup Drawing for DC2757A

TEST RESULTS

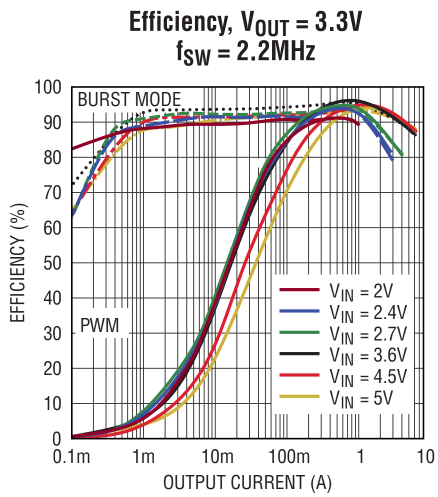

Figure 2. DC2757A Efficiency vs Output Current

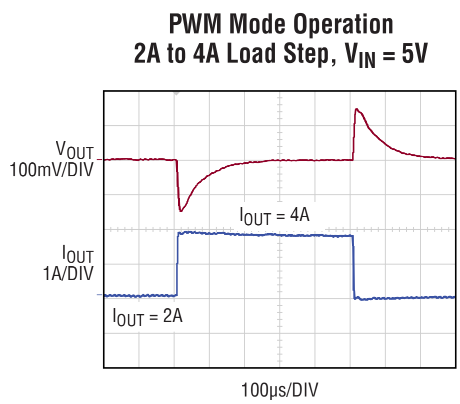

Figure 3. DC2757A Step Load Transient I_{OUT} = 2A to 4A at V_{IN} = 5V

TEST RESULTS

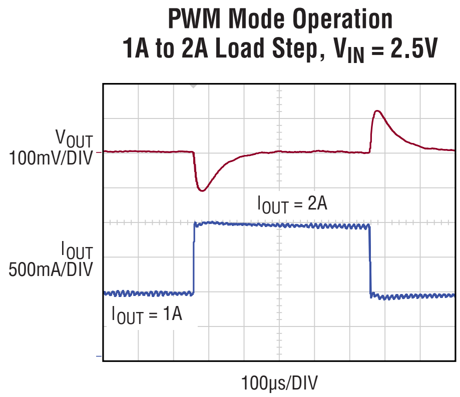

Figure 4. DC2757A Step Load Transient I_{OUT} = 1A to 2A at V_{IN} = 2.5V

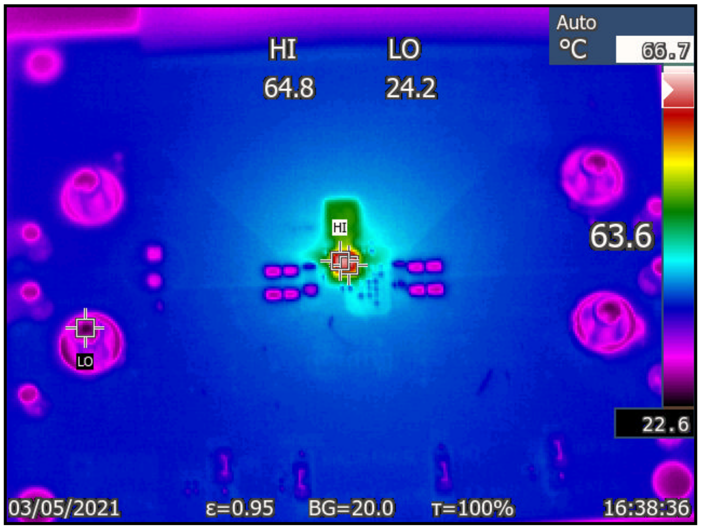

Figure 5. DC2757A Thermal Image for a 5V Input delivering 3.3V at 5A

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	C1, C9	CAP., 220µF, X5R, 6.3V, 20%, 1206	MURATA, GRM31CR60J227ME11L
2	3	C5, C6, C8	CAP., 1µF, X7R, 6.3V, 10%, 0402	MURATA, GRM155R70J105KA12D
3	1	C7	CAP CER 0.1µF 16V X7R 0402	AVX, 0402YC104KAT2A
4	1	C13	CAP., 0.047µF, X7R, 25V, 10%, 0402	AVX, 04023C473KAT2A
5	1	C14	CAP., 0.0018µF, X7R, 50V, 5%, 0402	AVX, 04025C182JAT2A
6	1	C15	CAP., 10pF, NP0, 50V, 10%, 0402	AVX, 04025A100KAT2A
7	1	C16	CAP., 15µF, X5R, 6.3V, 20%, 0402	MURATA, GRM155R60J156ME05D
8	1	L1	IND., 0.60µH, PWR., 20%, 4.9A, 5.9mΩ, XGL4020	COILCRAFT, XGL4020-601MEC
9	1	R1	RES., 499kΩ, 1%, 1/16W, 0402, AEC-Q200	NIC, NRC04F4993TRF
10	2	R2, R5	RES., 1MΩ, 1%, 1/16W, 0402, AEC-Q200	STACKPOLE ELECTRONICS, INC., RMCF0402FT1M00
11	1	R3	RES., 2MΩ, 5%, 1/16W, 0402	VISHAY, CRCW04022M00JNED
12	1	R4	RES., 34kΩ, 1%, 1/10W, 0402, AEC-Q200	KOA SPEER, RK73H1ETTP3402F
13	1	R6	RES., 432kΩ, 1%, 1/16W, 0402	VISHAY, CRCW0402432KFKED
14	1	R7	RES., 49.9Ω, 1%, 1/16W, 0402	ROHM, MCR01MZPF49R9
15	1	R9	RES., 34.8kΩ, 1%, 1/10W, 0402, AEC-Q200	KOA SPEER, RK73H1ETTP3482F
16	1	U1	IC, 6A Low Noise, High Performance Buck-Boost DC/DC Converter	ANALOG DEVICES, LT3154AV#PBF
Additional Demo Board Circuit Components				
1	0	C2, C3, C10, C11	CAP., OPTION, 1206	
2	0	C4	CAP., 220µF, ALUM. ELECT., 20V, 20%, THT RADIAL	NICHICON, PLV1D221MDL1TD
3	0	C12	CAP., OPTION, 0402	
4	0	LB1	LABEL SPEC, DEMO BOARD SERIAL NUMBER	BRADY, THT-96-717-10
5	0	R8	RES., OPTION, 0402	
Hardware: For Demo Board Only				
1	7	E1-E7	TEST POINT, TURRET, 0.094" MTG. HOLE, PCB 0.062" THK	MILL-MAX, 2501-2-00-80-00-00-07-0
2	4	E8-E11	CONN., BANANA JACK, FEMALE, THT, NON-INSULATED, SWAGE, 0.218"	KEYSTONE, 575-4
3	4	JP1-JP4	CONN., HDR, MALE, 1x3, 2mm, VERT, ST, THT	WURTH ELEKTRONIK, 62000311121
4	4	MP1-MP4	STANDOFF, NYLON, SNAP-ON, 0.25" (6.4mm)	KEYSTONE, 8831
5	4	XJP1-XJP4	CONN., SHUNT, FEMALE, 2-POS, 2mm	SAMTEC, 2SN-BK-G

SCHEMATIC DIAGRAM