LTC7138
High Efficiency, High V_{IN}, Step-Down Regulator

DESCRIPTION

Demonstration circuit 2172A is a high input voltage, 400mA step-down regulator featuring the LTC7138. The output of the regulator can be programmed for either 5V, 3.3V or 1.8V with on-board jumpers or is adjustable from 800mV to V_{IN} using an optional feedback divider. The input voltage range is from 4V to 140V. The LTC7138's Burst Mode® operation, low quiescent current and internal top FET switch provide high efficiency over a wide range of loads.

Other features include:

- Optional components to adjust the current limit, make it proportional to V_{IN} or improve the efficiency and reduce the output voltage ripple.
- FBO turret to tie two or more LTC7138 regulators together if the application requires more load current.
- Optional UVLO and OVLO divider.
- External/internal soft-start.

For more details, refer to the LTC7138 data sheet. The LTC7138 data sheet gives a complete description of the IC operation and application information. The data sheet must be read in conjunction with this quick start guide.

Design files for this circuit board are available at http://www.linear.com/demo/DC2172A

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	VALUE
Input Voltage Range		4V to 140V
5.0V Output Voltage	V_{IN} = 12V, I_{OUT} = 0mA to 400mA	5.0V ±2%
3.3V Output Voltage	V_{IN} = 12V, I_{OUT} = 0mA to 400mA	3.3V ±2%
1.8V Output Voltage	V_{IN} = 12V, I_{OUT} = 0mA to 400mA	1.8V ±2%
Maximum Output Current, I_{OUT}	V_{IN} = 4V to 140V, V_{OUT} = 5.0, 3.3V, 1.8V or ADJ ($V_{OUT} \leq V_{IN}$)	400mA
Typical Efficiency	V_{IN} = 12V, V_{OUT} = 5V, I_{OUT} = 400mA	82.3%
Typical Output Ripple	V_{IN} = 12V, V_{OUT} = 5V, I_{OUT} = 400mA	87mV_{P-P}

QUICK START PROCEDURE

Demonstration circuit 2172A is easy to set up to evaluate the performance of the LTC7138. Please refer to Figure 1 for proper measurement equipment setup and follow the procedure below.

1) With power off, connect the input supply, load and meters as shown in Figure 1. Preset the load to 0A and V_{IN} supply to 0V.
2) Place the RUN pin jumper (JP3) in the ON position.
3) Set the output to 5V by placing the JP1 jumper in the B position and the JP2 jumper in the A position.
4) Turn-on the V_{IN} supply and increase to 12V. The 5V output should be 5V ±2% per the Performance Summary table.
5) Next, apply 400mA load to the output and re-measure V_{OUT}.
6) Once the DC regulation is confirmed, observe the output voltage ripple, load step response, efficiency and other parameters for the 5V, 3.3V and 1.8V output settings.

Note 1. CAUTION: The maximum input voltage of the DC2172A is 140V. Voltages of 140V or lower are high enough to cause electric shock. Use great care when testing this demo board.

Note 2. For a 5V output, the input voltage should be 6V or more.

Note 3. 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.

QUICK START PROCEDURE

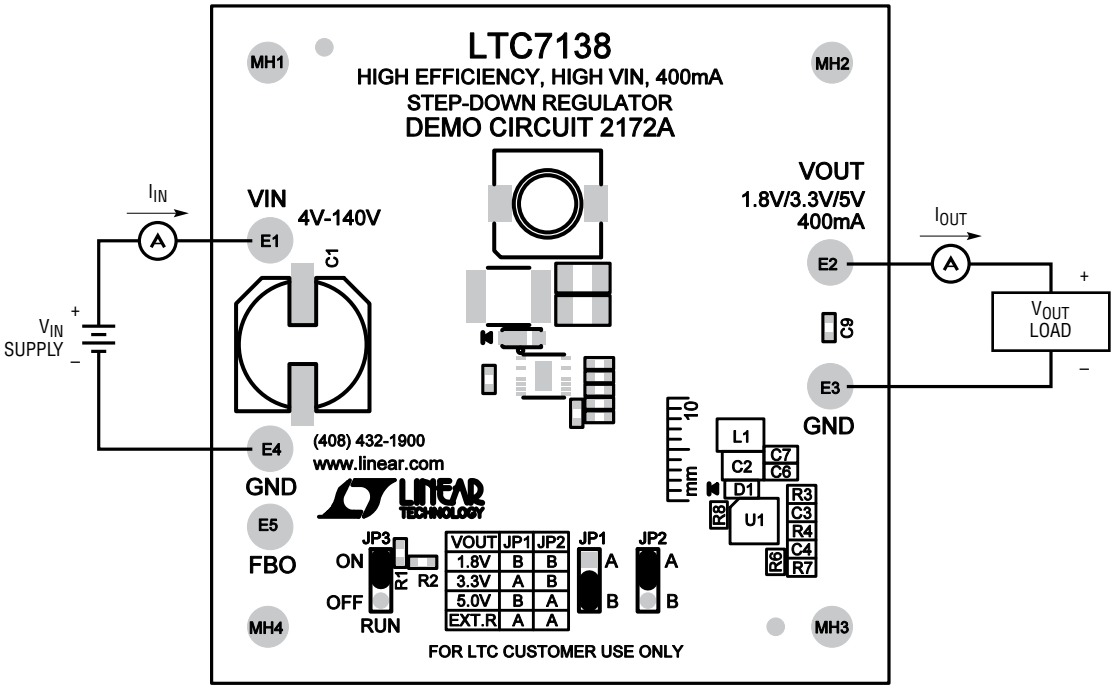


Figure 1. Proper Measurement Equipment Setup

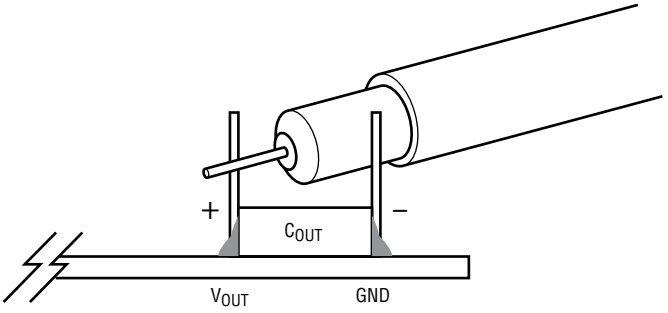


Figure 2. Measuring Output Voltage Ripple

QUICK START PROCEDURE

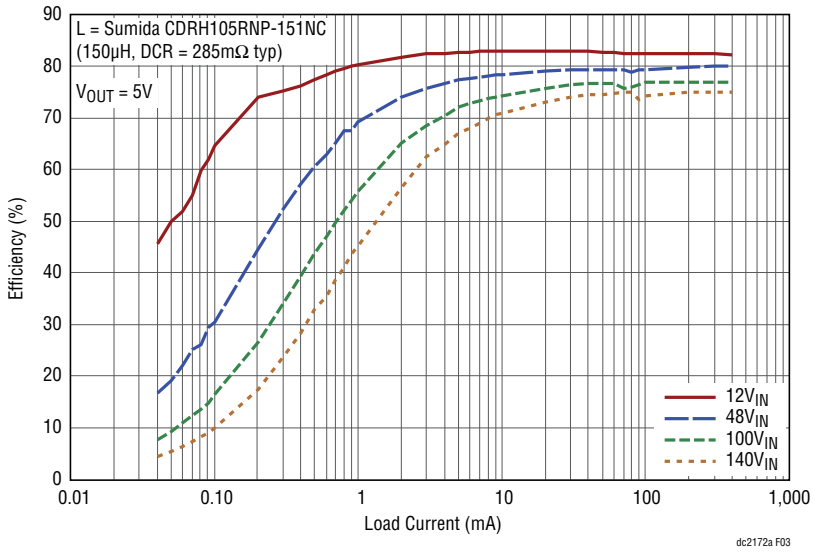


Figure 3. Efficiency at $5V_{OUT}$

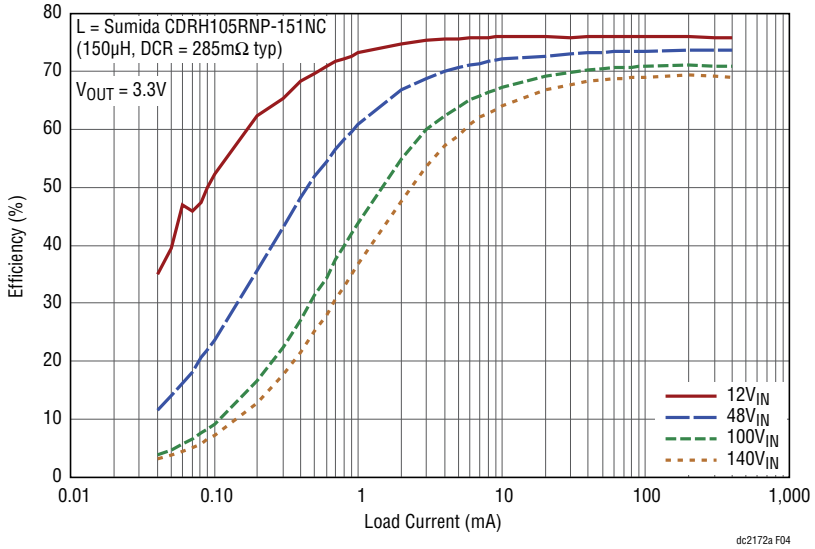


Figure 4. Efficiency at $3.3V_{OUT}$

QUICK START PROCEDURE

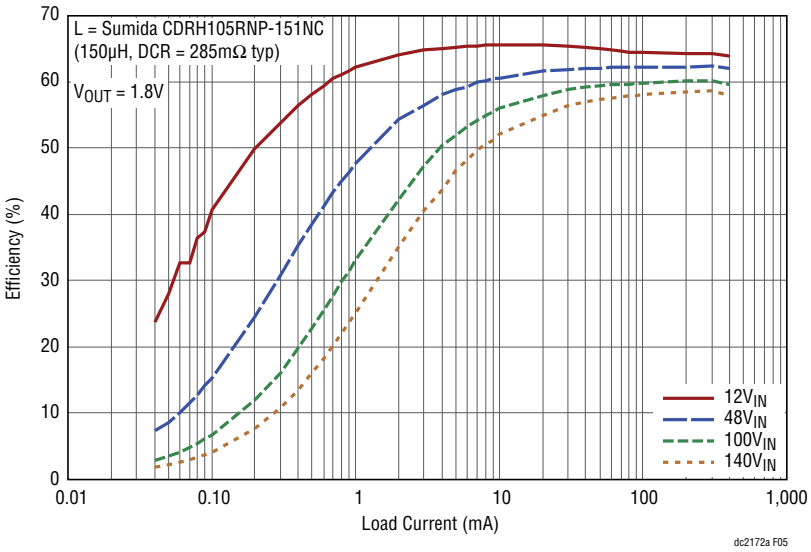
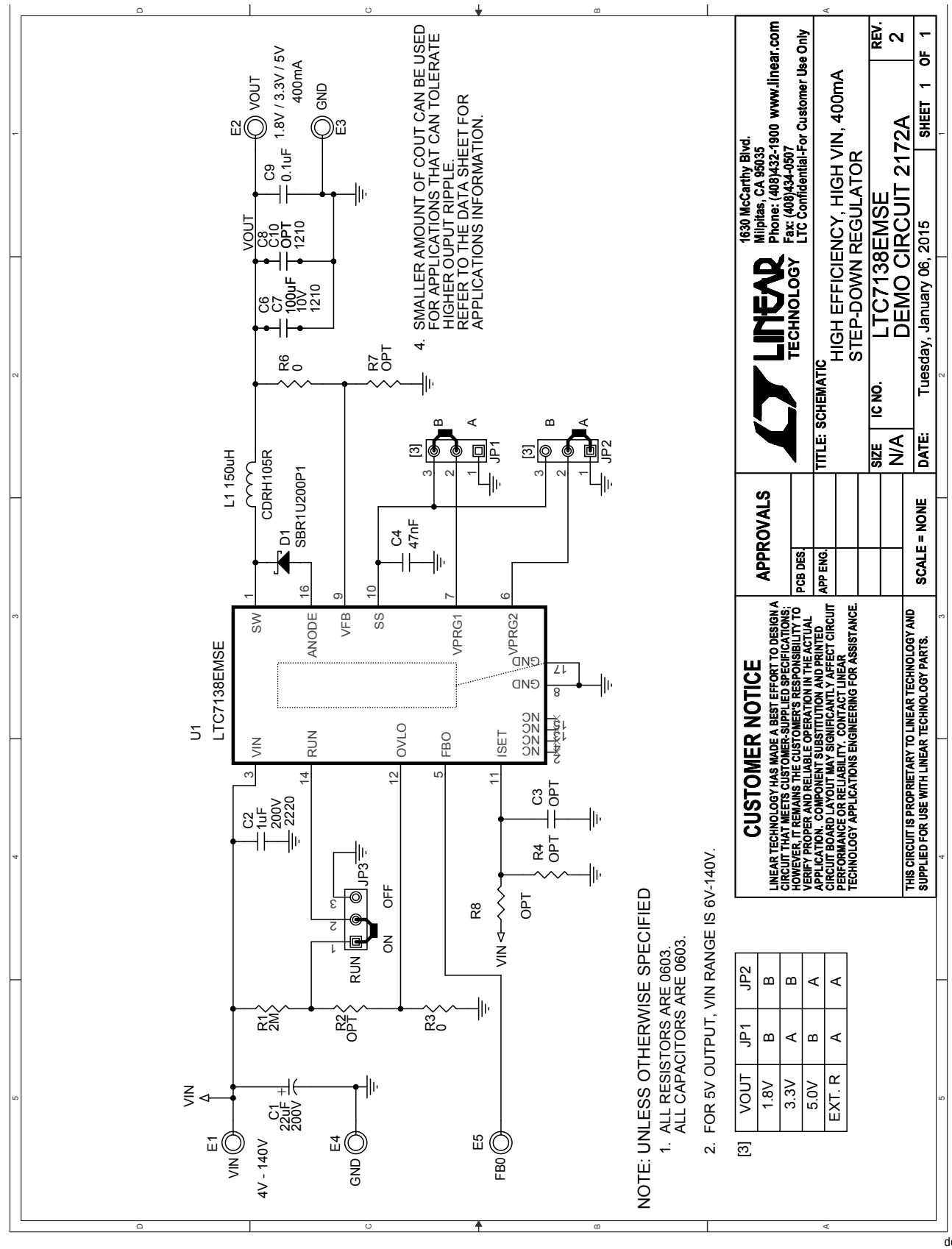


Figure 5. Efficiency at 1.8V_{OUT}

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP 22µF, 200V, ELEC	NIPPON CHEMI-CON, EMVE201ARA220MKG5S
2	1	C2	CAP 1µF, 2220, 10%, 200V, X7R	KEMET C2220X105K2RACTU
3	1	C4	CAP 47nF, 0603, 10%, 25V, X7R	AVX 06033C473KAT2A
4	2	C6, C7	CAP 100µF, 1210, 20%, 10V, X7R	TAIYO YUDEN LMK325ABJ107MMH-T
5	1	C9	CAP 0.1µF, 0603, 10%, 25V, X7R	AVX 06033C104KAT2A
6	1	D1	DIODE SBR1U200P1	DIODES, SBR1U200P1-7
7	1	L1	INDUCTOR 150µH	SUMIDA CDRH105RNP-151NC
8	1	R1	RES 2M, 0603Ω, 5%, 1/10W	VISHAY CRCW06032M00JNEA
9	1	U1	IC LTC7138EMSE	LINEAR TECH LTC7138EMSE#PBF
Additional Demo Board Circuit Components				
1	0	C3	CAP 0603 OPTION	OPTION
2	0	C8, C10	CAP 1210 OPTION	OPTION
3	0	R2, R4, R7, R8	RES 0603 OPTION	OPTION
4	2	R3, R6	RES 0Ω 0603 JUMPER	VISHAY CRCW06030000Z0ED
Hardware				
1	5	E1, E2, E3, E4, E5	TURRET	MILL-MAX 2501-2-00-80-00-00-07-0
2	3	JP1, JP2, JP3	HEADER 2mm PIN	SULLINS, NRPN031PAEN-RC
3	4	MH1, MH2, MH3, MH4	STANDOFF SNAP ON	KEYSTONE_8831
4	3	JP1, JP2, JP3	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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