LTM4657 20Vin, 8A Step-Down µModule® Regulator

DESCRIPTION

Demonstration circuit 2989A features the LTM4657 µModule® regulator, a high performance, high efficiency step-down regulator. The LTC®4657 is a complete DC/DC point-of-load regulator in a thermally enhanced 6.25mm x 6.25mm x 3.87mm BGA package. The LTM4657 has an operating input voltage range of 3.1V to 20V and provides an output current up to 8A. The output voltage is programmable from 0.6V to 5.5V and can be remotely sensed. The stacked inductor design improves thermal dissipation and significantly reduces the package area.

Output voltage tracking is available through the TRACK/SS pin for supply rail sequencing. External clock synchronization is available through the SYNC/MODE pin. For high efficiency at low load currents, select DCM mode operation using the MODE jumper (JP7) in less noise sensitive applications. The LTM4657 data sheet must be read in conjunction with this demo manual for working on or modifying DC2989A.

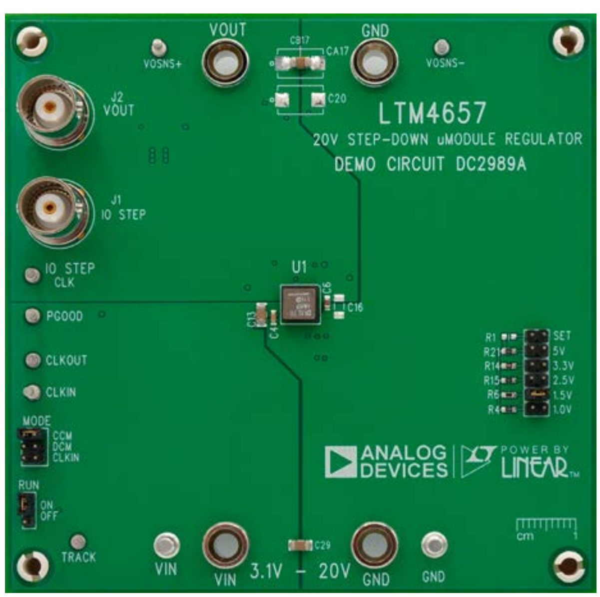
Design files for this circuit board are available.

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	VALUE
Input Voltage Range		3.1V – 20V
Output Voltage V_{OUT}	Jumper selectable	1VDC, 1.5VDC, 2.5VDC, 3.3VDC, 5VDC
Maximum Continuous Output Current	Derating is necessary for certain operating conditions. See datasheet for details	8ADC
Default Operating Frequency		500kHz
Efficiency	V_{IN} = 12V, V_{OUT} = 1.5V, I_{OUT} = 8A	88.3%

BOARD PHOTO



Rev. 0

QUICK START PROCEDURE

Demonstration circuit 2989A is an easy way to evaluate the performance of the LTM4657. Please refer to Figure 1 for test setup connections and follow the procedure below.

1. With power off, place the jumpers in the following positions:

JUMPER	POSITION	FUNCTION
JP8	JP7	JP6
RUN	MODE	V_{OUT} SELECT
ON	CCM	1.5V

2. Before connecting input supply, load and meters, preset the input voltage supply to be between 3.1V to 20V. Preset the load current to 0A.
3. With power off, connect the load, input voltage supply and meters as shown in Figure 1.
4. Turn on input power supply. The output voltage meters for each phase should display the programmed output voltage ± 2%.
5. Once the proper output voltage is established, adjust the load current within the 0-8A range and observe the load regulation, efficiency, and other parameters. Output voltage ripple should be measured across the furthest output cap with a BNC cable and oscilloscope from J2.
6. To observe increased light load efficiency, place the MODE pin jumper (JP7) in the DCM position.
7. For optional load transient testing, an on-board transient circuit is provided to measure tran-sient response. Place a positive pulse signal between the IO_STEP_CLK pin and GND pins. The pulse amplitude sets the load step current amplitude. The pulse width should be short (<1ms) and pulse duty cycle should be low (<15%) to limit the thermal stress on the load transient circuit. The load step response can be monitored with a BNC connected to J1 (5mV/A).

QUICK START PROCEDURE

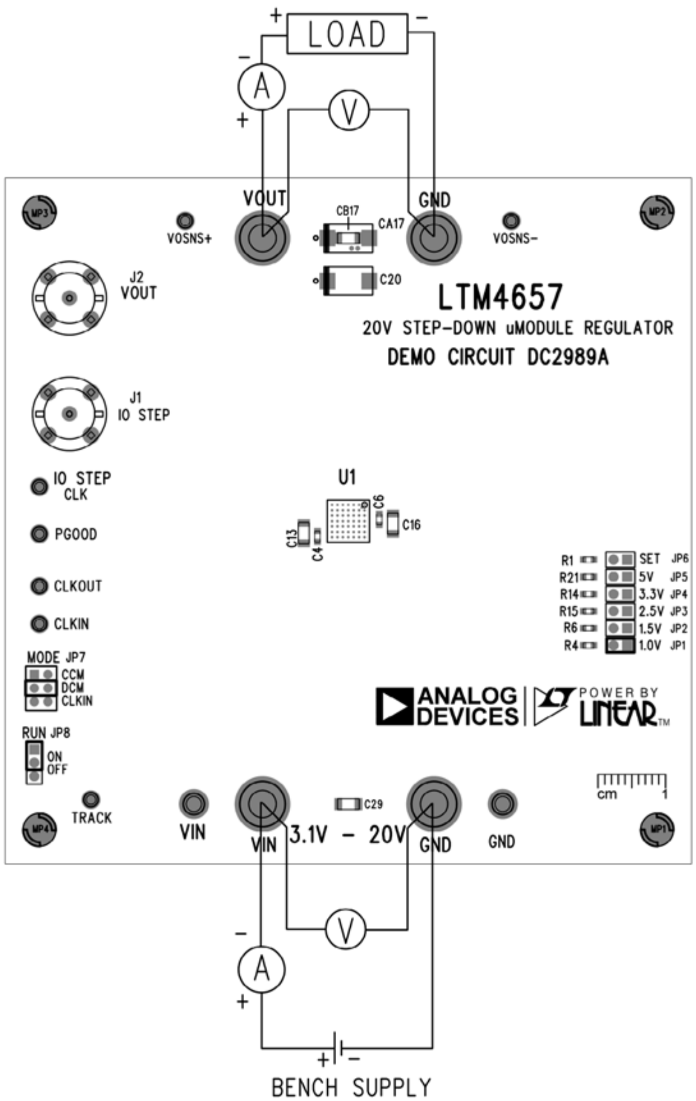
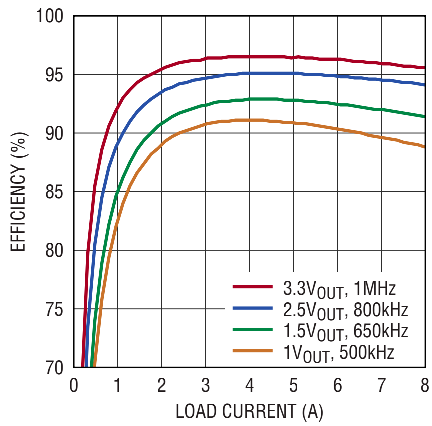


Figure 1. Test Setup of DC2989A

QUICK START PROCEDURE



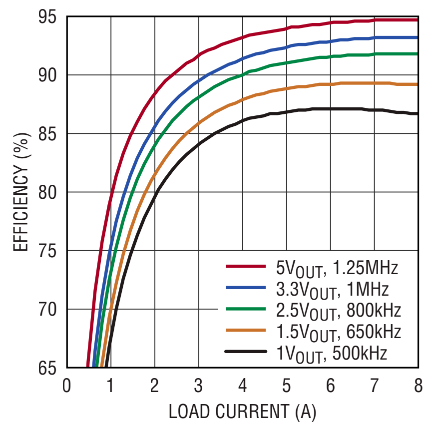


Figure 2. Measured Supply Efficiency at $5V_{IN}$ and $12V_{IN}$

QUICK START PROCEDURE

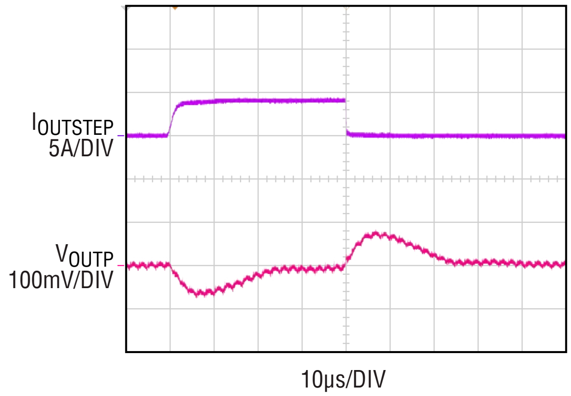


Figure 3. Load Transient (4A to 8A) Response Waveform at $12V_{IN}$ and 1.5Vout, 10µs/div

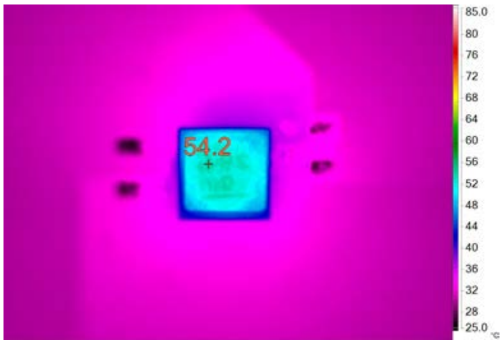
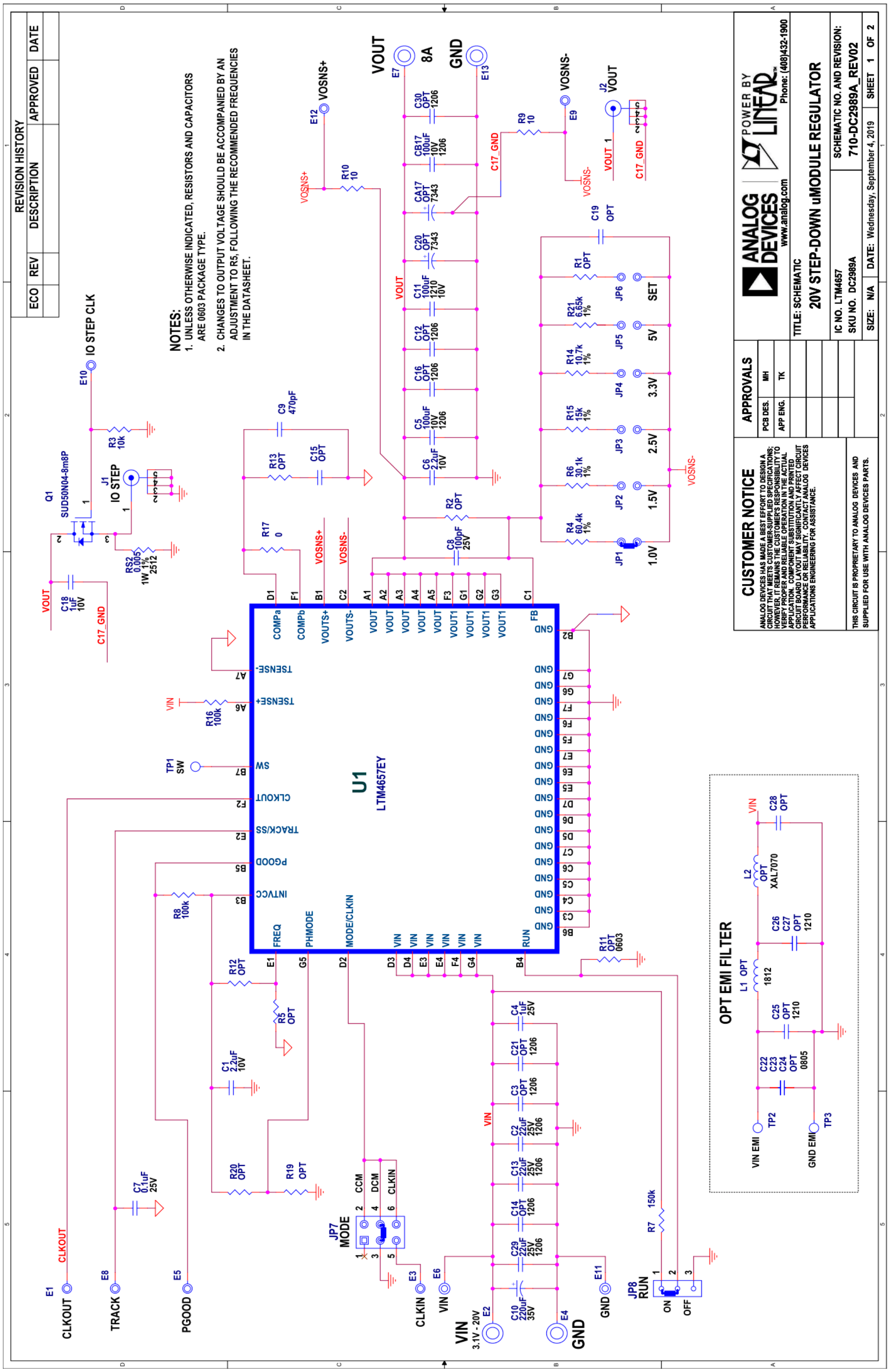


Figure 4. Measured Thermal Capture at $12V_{IN}$ and $1.5V_{OUT}$, $8A_{OUT}$ at 25°C Ambient with No Airflow

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	C1, C6	CAP, 2.2uF, X7R, 10V, 20%, 0603	TDK, C1608X7R1A225M080AC
2	3	C2, C13, C29	CAP, 22uF, X5R, 25V, 10%, 1206	AVX, 12063D226KAT2A
3	1	C4	CAP, 1uF, X7R, 25V, 10%, 0603	TAIYO YUDEN, TMK107B7105KA-T
4	2	C5, CB17	CAP, 100uF, X5R, 10V, 20%, 1206	TDK, C3216X5R1A107M160AC
5	1	C7	CAP, 0.1uF, X7R, 25V, 10%, 0603	AVX, 06033C104KAT2A
6	1	C8	CAP, 100pF, X7R, 25V, 5%, 0603	AVX, 06033C101JAT2A
7	1	C9	CAP, 470pF, X7R, 50V, 10%, 0603	AVX, 06035C471KAT2A
8	1	C10	CAP, 220uF, ALUM. ELECT., 35V	SUN ELEC, 35HVH220M
9	1	C11	CAP, 100uF, X5R, 10V, 20%, 1210	KEMET, C1210C107M8PACTU
10	1	C18	CAP, 1uF, X7R, 10V, 20%, 0603	AVX, 0603ZC105MAT2A
11	1	Q1	XSTR, MOSFET, N-CH, 40V, TO-252 (DPAK)	VISHAY, SUD50N04-8M8P-4GE3
12	1	R3	RES, 10k OHMS, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW060310K0FKEA
13	1	R4	RES, 60.4k OHMS, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW060360K4FKEA
14	1	R6	RES, 30.1k OHMS, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW060330K1FKEA
15	1	R7	RES, 150k OHMS, 5%, 1/10W, 0603, AEC-Q200	PANASONIC, ERJ3GEYJ154V
16	2	R8, R16	RES, 100k OHMS, 1%, 1/10W, 0603	STACKPOLE, RMCF0603FG100K
17	2	R9, R10	RES, 10 OHMS, 1%, 1/10W, 0603	VISHAY, CRCW060310R0FKEA
18	1	R14	RES, 10.7k OHMS, 1%, 1/10W, 0603	NIC, NRC06F1072TRF
19	1	R15	RES, 15k OHMS, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW060315K0FKEA
20	1	R17	RES, 0 OHM, 1/10W, 0603, AEC-Q200	VISHAY, CRCW06030000Z0EA
21	1	R21	RES, 6.65k OHMS, 1%, 1/10W, 0603	NIC, NRC06F6651TRF
22	1	RS2	RES, 0.005 OHM, 1%, 1W, 2512	VISHAY, WSL25125L000FEA
23	1	U1	IC, Step-Down uModule Reg, BGA-49	ANALOG DEVICES, LTM4657EY#PBF
Additional Demo Board Circuit Components				
1	0	C3, C12, C14, C16, C21, C30	CAP, OPTION, 1206	N/A
2	0	C15, C19	CAP, OPTION, 0603	N/A
3	0	C20, CA17	CAP, OPTION, 7343	N/A
4	0	C22-C24	CAP, OPTION, 0805	N/A
5	0	C25-C28	CAP, OPTION, 1210	N/A
6	0	L1	IND, OPTION, 1812	N/A
7	0	L2	IND, OPTION, COILCRAFT XAL7070	N/A
8	0	R1, R2, R5, R11-R13, R19, R20	RES, OPTION, 0603	N/A
Hardware: For Demo Board Only				
1	7	E1, E3, E5, E8-E10, E12	TEST POINT, TURRET, 0.064	MILL-MAX, 2308-2-00-80-00-00-07-0
2	4	E2, E4, E7, E13	BANANA JACK, FEMALE	KEYSTONE, 575-4
3	2	E6, E11	TEST POINT, TURRET, 0.094	MILL-MAX, 2501-2-00-80-00-00-07-0
4	2	J1, J2	CONN, BNC, 5-PIN	AMPHENOL RF, 112404
5	6	JP1-JP6	HEADER, 1x2, 2mm	SULLINS, NRPN021PAEN-RC
6	1	JP7	HEADER, 2x3, 2mm	SULLINS, NRPN032PAEN-RC
7	1	JP8	HEADER, 1x3, 2mm	SAMTEC, TMM-103-02-L-S
8	4	MP1-MP4	STANDOFF, NYLON, SNAP-ON, 0.50	KEYSTONE, 8833
9	3	XJP1, XJP7, XJP8	CONN, SHUNT, FEMALE, 2-POS, 2mm	SAMTEC, 2SN-BK-G

SCHEMATIC DIAGRAM



ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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