DEMO MANUAL DC1905A

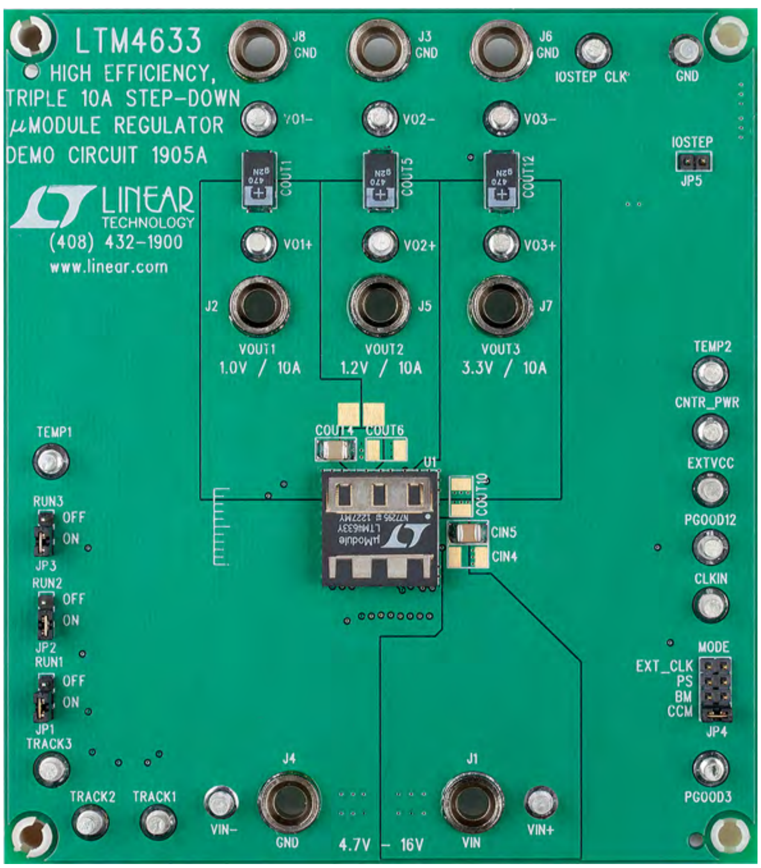
LTM4633
High Efficiency, Triple 10A Step-Down µModule Regulator

DESCRIPTION

Demonstration circuit DC1905A features the LTM®4633EY, a high efficiency, triple 10A step-down power µModule® regulator. The input voltage range is from 4.7V to 16V with common input source, or 2.375V to 16V with an external bias supply. The output voltage range is 0.8V to 1.8V for Channel 1 and Channel 2, 0.8V to 5.5V for Channel 3. Derating is necessary for certain V_{IN}, V_{OUT}, frequency and thermal conditions. The DC1905A offers access to the TRACK/SS pins allowing the user to program output tracking or soft-start period. The board operates in continuous conduction mode in heavy load conditions. For high efficiency at low load currents, the MODE jumper (JP4) selects pulse-skipping mode for noise sensitive applications or Burst-Mode® operation in less noise sensitive applications. Channel 1 and 2 can be connected in parallel for a single 20A output solution with optional jumper resistors. The LTM4633 data sheet must be read in conjunction with this demo manual prior to working on or modifying demo circuit DC1905A.

Design files for this circuit board are available at http://www.linear.com/demo/DC1905A

BOARD PHOTO



PERFORMANCE SUMMARY Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	VALUE
Input Voltage Range		4.7V to 16V
Output Voltages		1.0V, 1.2V, 3.3V ±1.5%
Maximum Continuous Output Current	Derating Is Necessary for Certain Operating Conditions. See Data Sheet for Details	10ADC for Each Channel
Operating Frequency		750kHz
Efficiency of Channel 1	V_{IN} = 12V, V_{OUT1} = 1.0V, I_{OUT1} = 10A	77% See Figure 2
Efficiency of Channel 2	V_{IN} = 12V, V_{OUT2} = 1.2V, I_{OUT2} = 10A	81% See Figure 3
Efficiency of Channel 3	V_{IN} = 12V, V_{OUT3} = 3.3V, I_{OUT3} = 10A	91% See Figure 4
Load Transient of Channel 1	V_{IN} = 12V, V_{OUT1} = 1.0V, I_{STEP} = 0A to 5A	See Figure 5
Load Transient of Channel 2	V_{IN} = 12V, V_{OUT2} = 1.2V, I_{STEP} = 0A to 5A	See Figure 6
Load Transient of Channel 3	V_{IN} = 12V, V_{OUT3} = 3.3V, I_{STEP} = 0A to 5A	See Figure 7

QUICK START PROCEDURE

Demonstration circuit DC1905A is an easy way to evaluate the performance of the LTM4633EY. Please refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. Place jumpers in the following positions for a typical application:

RUN1	RUN2	RUN3	MODE
ON	ON	ON	CCM

2. With power off, connect the input power supply, loads and meters as shown in Figure 1. Preset the load to 0A and V_{IN} supply to 12V.
3. Turn on the power supply at the input. The output voltage of channel 1 should be 1.0V ±1.5% (0.985V to 1.015V). The output voltage of channel 2 should be 1.2V ±1.5% (1.182V to 1.218V). The output voltage of channel 3 should be 3.3V ±1.5% (3.25V to 3.349V).
4. Vary the input voltage from 4.7V to 16V and adjust the load current of each channel from 0A to 10A. Observe the output voltage regulation, ripple voltage, efficiency, and other parameters.
5. (Optional) For optional load transient test, apply an adjustable pulse signal between IOSTEP_CLK and GND test points. The pulse amplitude sets the load step current amplitude. Keep the pulse width short (<1ms) and pulse duty cycle low (<5%) to limit the thermal stress on the load transient circuit. Switch the jumper resistors R30, R31 or R34 (on the backside of boards) to apply load transient on channel 1, channel 2, or channel 3 respectively.
6. (Optional) LTM4633 can be synchronized to an external clock signal. Place the JP4 jumper on EXT_CLK and apply a clock signal (0V to 5V, square wave) on the CLKIN test point.
7. (Optional) The outputs of LTM4633 can track another supply. If tracking external voltage is selected, the corresponding test points, TRACK1, TRACK2, and TRACK3, need to be connected to a valid voltage signal.
8. (Optional) Channel 1 and 2 can be connected in parallel for a 20A polyphase operation on DC1905A. Install 0Ω resistors on R32, R33, R35, R36 and remove R15. Output voltage is set by R4 based on equation V_{OUT} = 0.8V (1 + 60.4k/2/R4).

QUICK START PROCEDURE

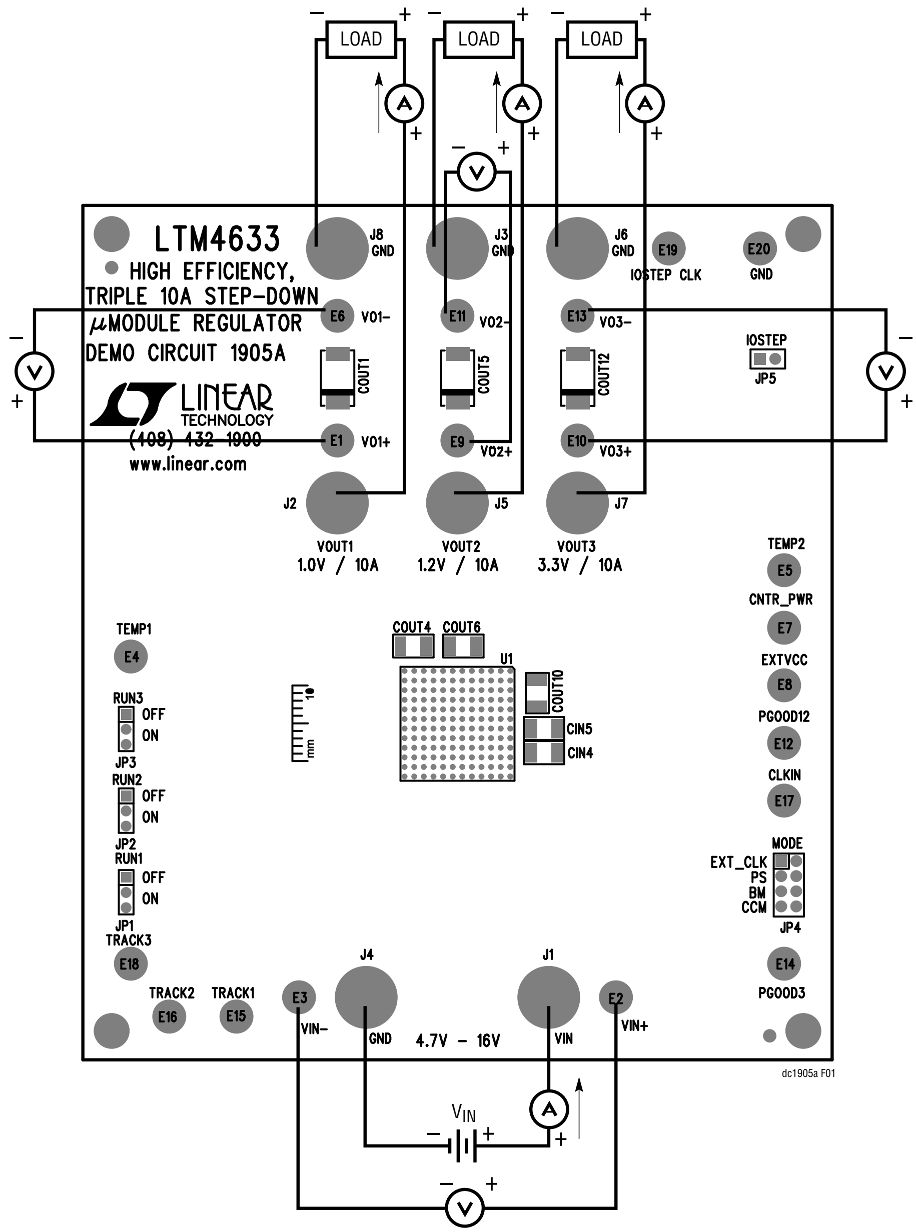


Figure 1. Measurement Setup of DC1905A

QUICK START PROCEDURE

DC1905A Efficiency (LTM4633) V_{OUT} = 1.0V

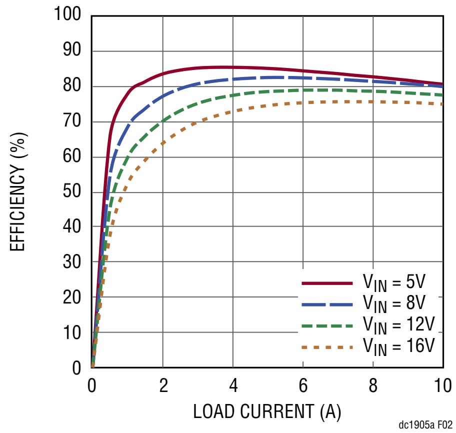


Figure 2. Measured Efficiency on Channel 1. V_{OUT1} = 1.0V, f_{SW} = 750kHz, CCM, Channel 2, 3 Disabled

DC1905A Efficiency (LTM4633) V_{OUT} = 1.2V

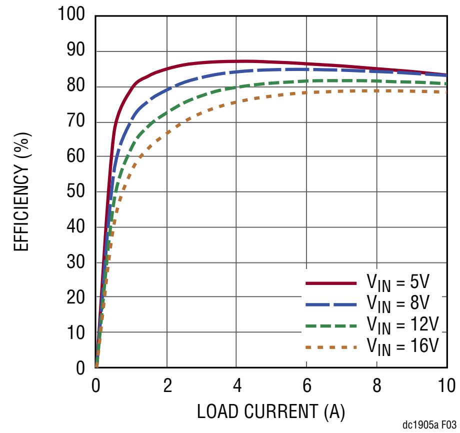


Figure 3. Measured Efficiency on Channel 2. V_{OUT2} = 1.2V, f_{SW} = 750kHz, CCM, Channel 1, 3 Disabled

DC1905A Efficiency (LTM4633) V_{OUT} =3.3V

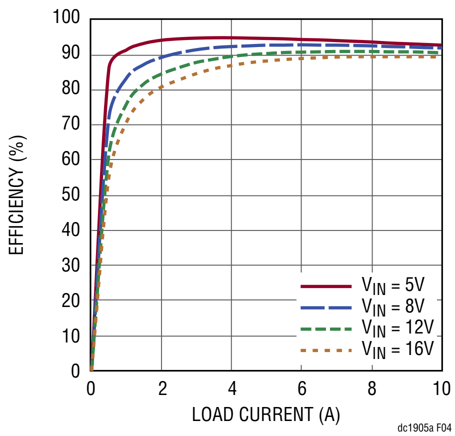


Figure 4. Measured Efficiency on Channel 3. V_{OUT3} = 3.3V, f_{SW} = 750kHz, CCM, Channel 1, 2 Disabled

QUICK START PROCEDURE

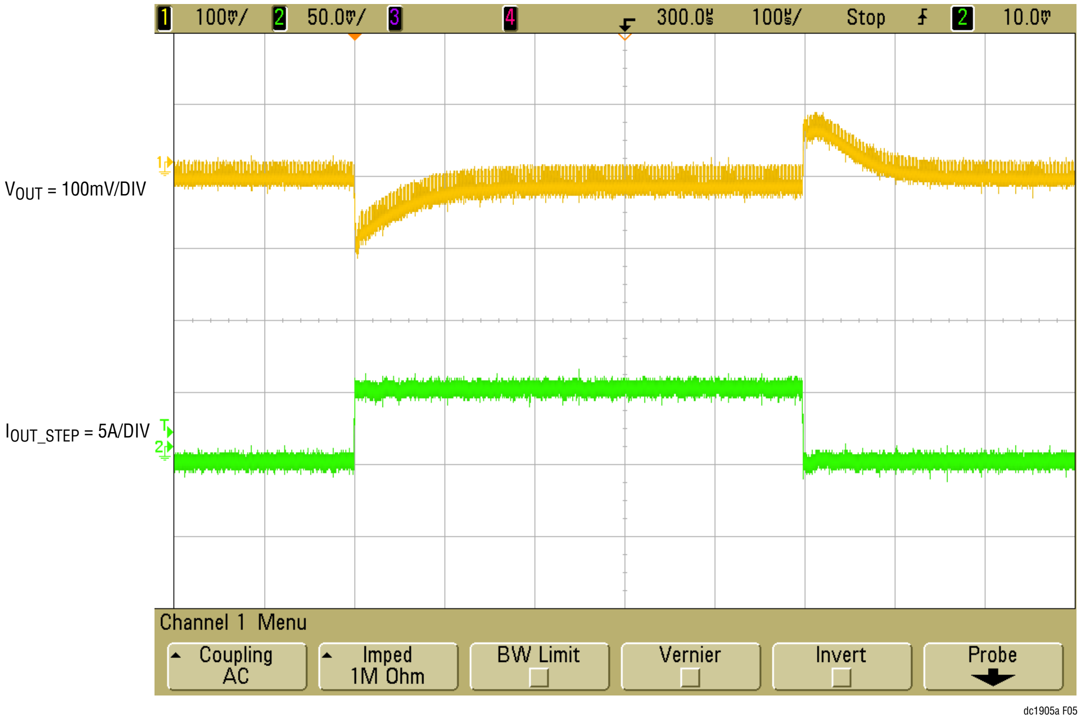


Figure 5. Measured Channel 1 Load Transient
V_{IN} = 12V, V_{OUT1} = 1.0V, I_{STEP} = 0A to 5A, di/dt = 5A/µs

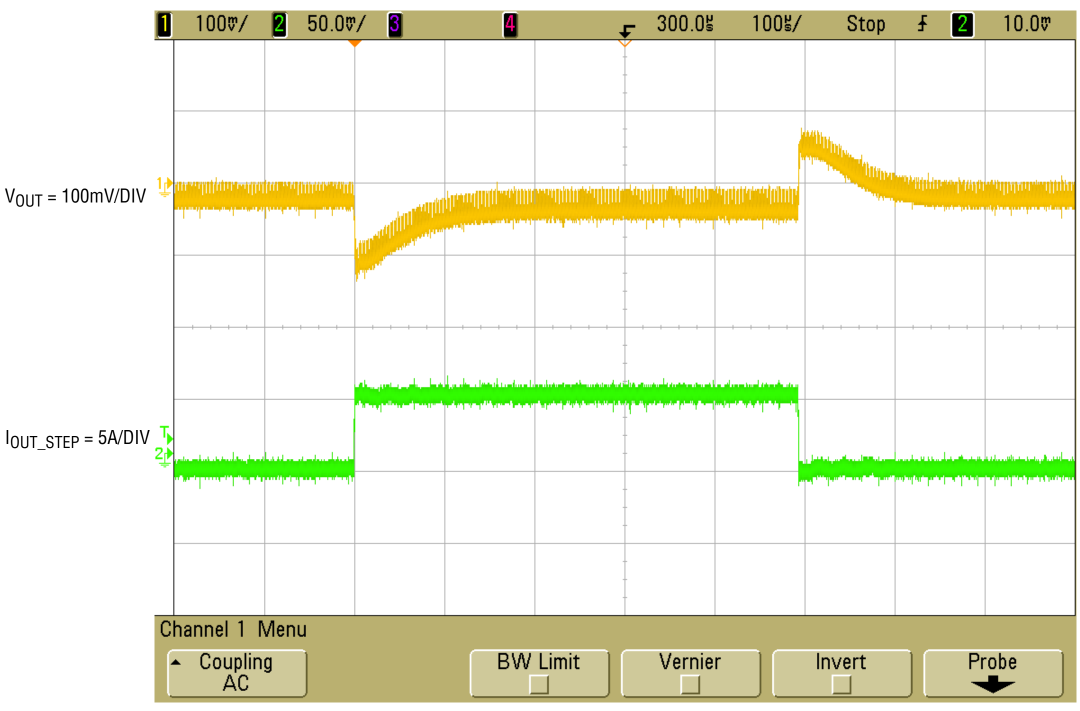


Figure 6. Measured Channel 2 Load Transient
V_{IN} = 12V, V_{OUT1} = 1.2V, I_{STEP} = 0A to 5A, di/dt = 5A/µs

QUICK START PROCEDURE

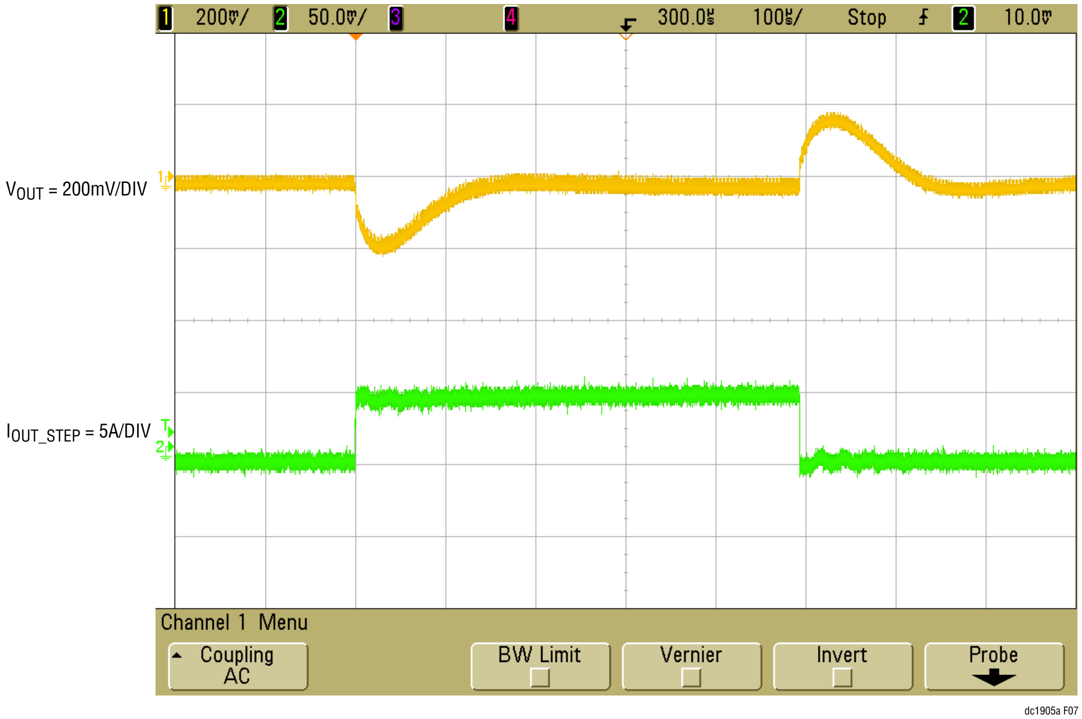


Figure 7. Measured Channel 3 Load Transient
V_{IN} = 12V, V_{OUT3} = 3.3V, I_{STEP} = 0A to 5A

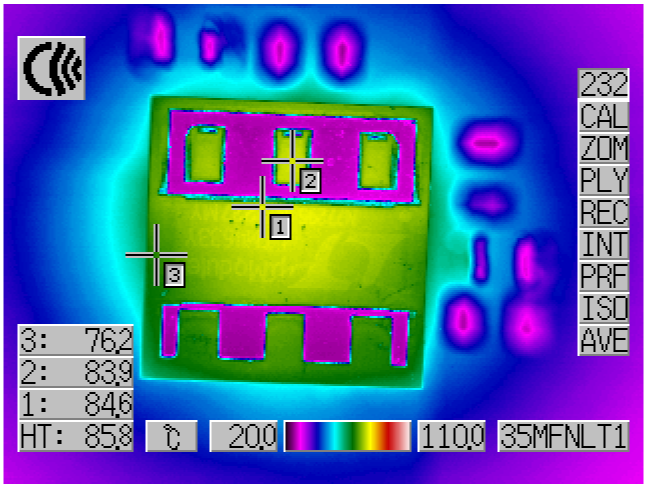


Figure 8. Thermal Image of LTM4633
V_{IN} = 12V, V_{OUT1} = 1.0V, I_{LOAD1} = 10A,
V_{OUT2} = 1.2V, I_{LOAD2} = 10A, V_{OUT3} = 3.3V, I_{LOAD3} = 2A
Ambient Temperature= 21.6°C, No Forced Air Flow

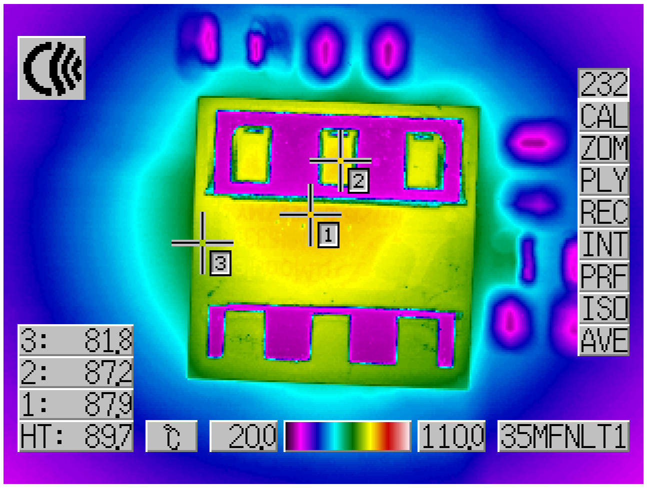
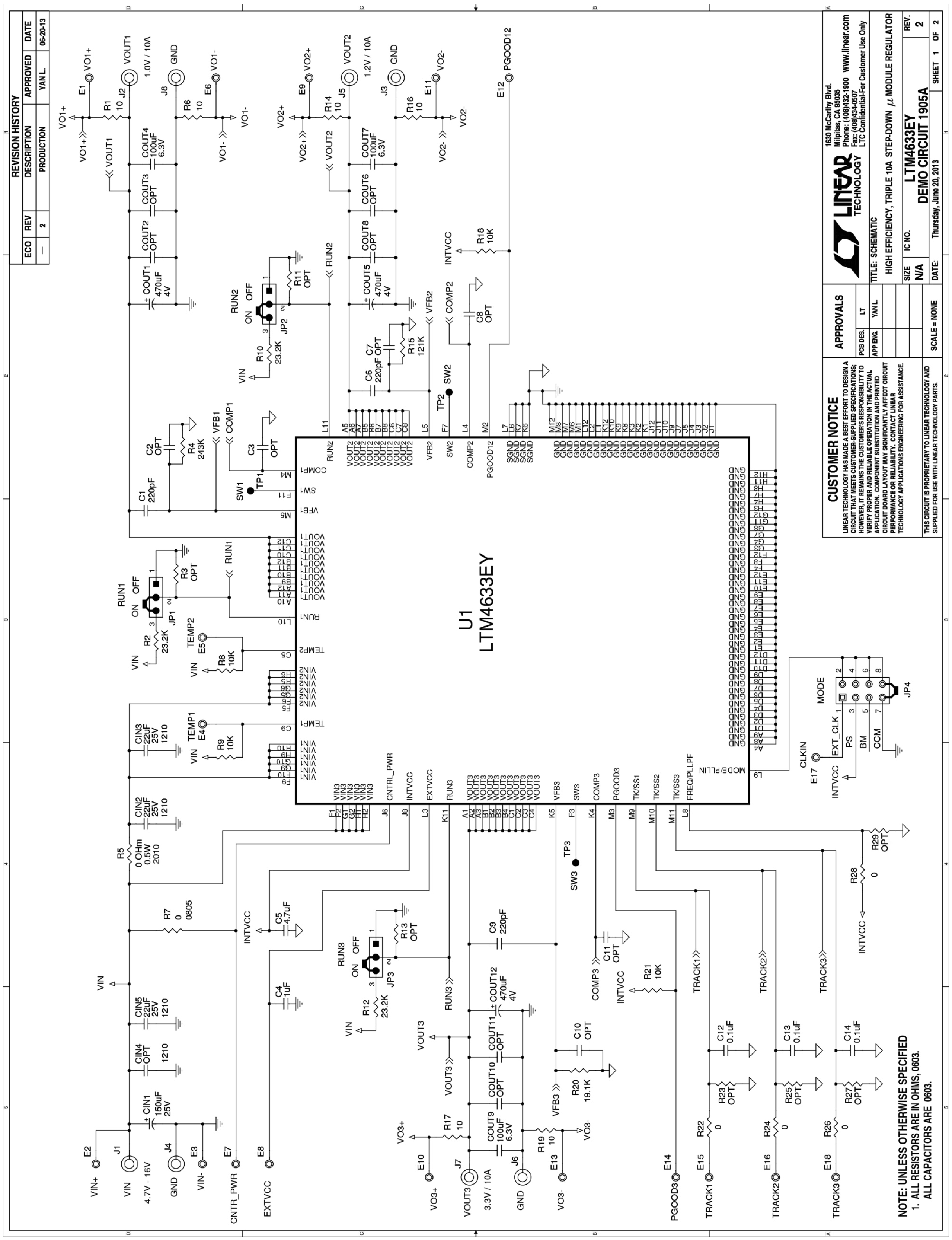


Figure 9. Thermal Image of LTM4633
V_{IN} = 12V, V_{OUT1} = 1.0V, I_{LOAD1} = 10A,
V_{OUT2} = 1.2V, I_{LOAD2} = 10A, V_{OUT3} = 3.3V, I_{LOAD3} = 5A
Ambient Temperature= 21.6°C, No Forced Air Flow

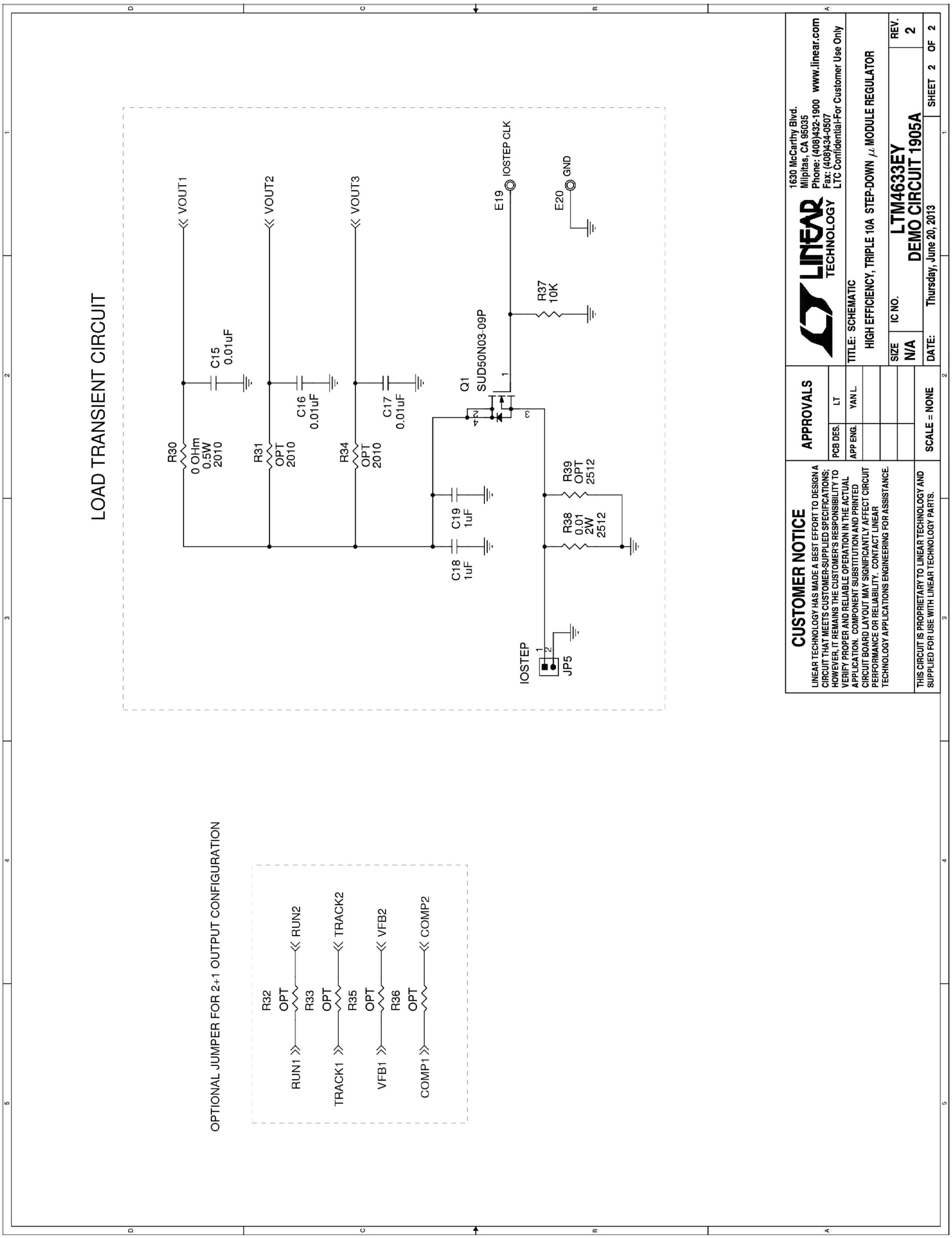
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	U1	LTM4633EY#PBF, BGA-15 × 15-144P	LINEAR TECH., LTM4633EY#PBF
2	1	CIN1	Cap., 150µF, 25V, Aluminum Electr.,	SUN ELECT., 25CE150AX
3	3	CIN2, CIN3, CIN5	Cap., X5R, 22µF, 25V, 10%,1210	MURATA, GRM32ER61E226KE15L
4	1	C5	Cap., X5R, 4.7µF, 10V,10%, 0603	AVX, 0603ZD475KAT2A
5	1	C4	Cap., X7R, 1µF, 10V,10%, 0603	AVX, 0603ZC105KAT2A
6	3	COUT1, COUT5, COUT12	Cap., 470µF, 4V, POSCAP, F8	SANYO, 4TPE470MCL
7	3	COUT4, COUT7, COUT9	Cap., X5R, 100µF, 6.3V, 20%, 1210	AVX, 12106D107MAT2A
8	3	C1, C6, C9	CAP., 220pF, 10%, 50V, NPO 0603	AVX, 06035A221KAT
9	3	C12, C13, C14	Cap., X5R, 0.1µF,25V, 10%, 0603	AVX, 06033D104KAT2A
10	4	R1, R6, R14, R16, R17, R19	Res., Chip, 10, 1%, 0603	VISHAY, CRCW060310R0FKEA
11	1	R4	Res., Chip, 243k, 1%, 0603	VISHAY, CRCW0603243K0FKEA
12	4	R8, R9, R18, R21	Res., Chip, 10k, 1%, 0603	VISHAY, CRCW060310K0FKEA
13	1	R15	Res., Chip, 121k, 1%, 0603	VISHAY, CRCW0603121K0FKEA
14	1	R20	Res., Chip, 19.1k, 1%, 0603	VISHAY, CRCW060319K1FKEA
Additional Demo Board Circuit Components				
1	2	C18, C19	Cap., X7R, 1µF, 10V,10%, 0603	AVX, 0603ZC105KAT2A
2	0	COUT2, COUT3, COUT6, COUT8, COUT10, COUT11	1210	OPT
3	0	C2, C3, C7, C8, C10, C11	0603	OPT
4	3	C15, C16, C17	CAP., X7R, 0.01µF, 50V, 10%, 0603	AVX, 06035C103KAT2A
5	1	Q1	N-Channel 30-V MOSFET	VISHAY, SUD50N03-09P-GE3
6	3	R2, R10, R12	Res., Chip, 23.2k, 1%, 0603	VISHAY, CRCW060323K2FKEA
7	2	R5, R30	Res., Chip, 0Ω, 0.5W, 2010	TEPRO,RN6083
8	1	R7	Res., Chip, 0Ω, 1%, 0805	VISHAY, CRCW08050000Z0ED
9	1	R37	Res., Chip, 10k, 1%, 0603	VISHAY, CRCW060310K0FKEA
10	4	R22, R24, R26, R28	Res., Chip, 0Ω, 1%, 0603	VISHAY, CRCW06030000Z0EA
11	0	R31, R34	2010	OPT
12	1	R38	Res., Chip, 0.01Ω, 2W, 2512	VISHAY, WSL2512R0100FEA
13	0	R39	2512	OPT
14	0	R3, R11, R13, R23, R25, R27, R29, R32, R33, R35, R36	0603	OPT
15	0	CIN4	1210	OPT
Hardware: For Demo Board Only				
1	20	E1-E20	TESTPOINT, TURRET, .094" PBF	MILL-MAX, 2501-2-00-80-00-00-07-0
2	3	JP1, JP2, JP3	HEADER 3 PIN, 0.079 SINGLE ROW	SAMTEC, TMM103-02-L-S
3	1	JP4	HEADER 8 PIN, 0.079 DOUBLE ROW	SAMTEC, TMM104-02-L-D
4	1	JP5	HEADER 2 PIN, 0.079 SINGLE ROW	SAMTEC, TMM102-02-L-S
5	8	J1-J8	JACK BANANA	KEYSTONE, 575-4
6	4	XJP1-XJP4	SHUNT, .079" CENTER	SAMTEC, 2SN-BK-G
7	4	(STAND-OFF)	STAND-OFF, NYLON, 0.50"	KEYSTONE, 8833(SNAP ON)

SCHEMATIC DIAGRAM



SCHEMATIC DIAGRAM



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