

LTM4645 25A DC/DC Step-Down µModule Regulator

DESCRIPTION

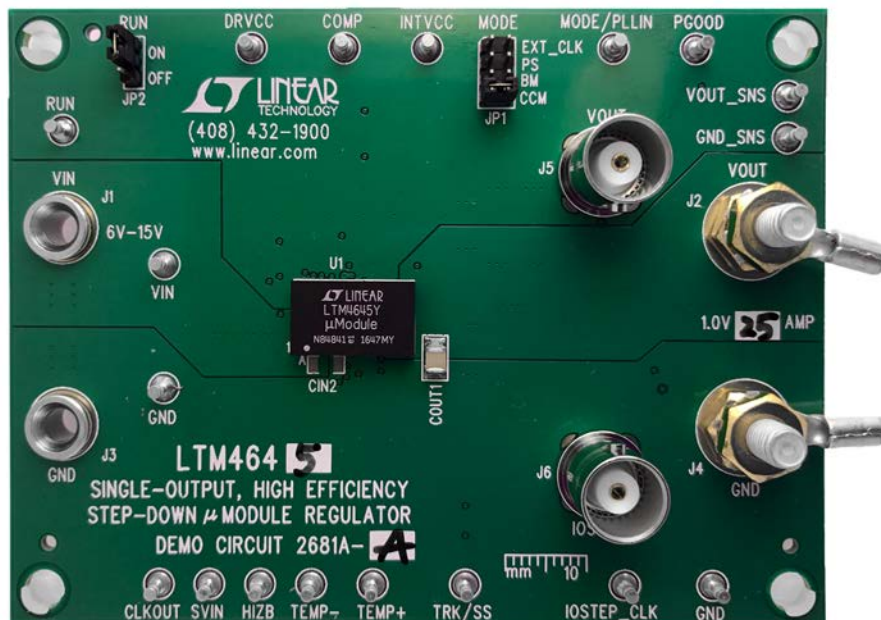
Demonstration circuit 2681A-A features the [LTM®4645EY](#), a 25A high efficiency, switch mode step-down power µModule® regulator. The input voltage range is from 6V to 15V. To use DC2681A-A for input voltage range from 4.7V to 6V, connect INTV_{CC} to SV_{IN} (change R22 from OPT to 0Ω), DRV_{CC} to V_{IN} (change R21 from 0Ω to OPT, R28 from OPT to 0Ω). The output voltage range is 0.6V to 1.8V. Derating is necessary for certain V_{IN}, V_{OUT}, frequency and thermal conditions. The DC2681A-A offers the TRK/SS pin 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_PLLIN jumper selects

pulse-skipping mode for noise sensitive applications or burst mode operation in less noise sensitive applications. The MODE_PLLIN pin also allows the LTM4645 to synchronize to an external clock signal (between 400kHz and 800kHz). DC2681A-A has the option of choosing both internal and external compensation circuit for LTM4645. Tying the PHASMD pin to different voltage generates certain phase difference between MODE_PLLIN and CLKOUT. The LTM4645 data sheet must be read in conjunction with this demo manual prior to working on or modifying demo circuit DC2681A-A.

[Design files for this circuit board are available.](#)

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BOARD PHOTO



PERFORMANCE SUMMARY

PARAMETER	CONDITIONS/NOTES	VALUE
Input Voltage Range		6V to 15V
Output Voltages		1.0V \pm 1.0%
Maximum Continuous Output Current	Derating is Necessary for Certain Operating Conditions. See Data Sheet for Details	25ADC
Operating Frequency		600kHz
Efficiency	$V_{IN} = 12V, V_{OUT} = 1.0V, I_{OUT} = 25A$	84.6% Figure 2
Load Transient $V_{OUT(P-P)}$	$V_{IN} = 12V, V_{OUT} = 1.0V, I_{STEP} = 0A \text{ to } 12.5A$	128mV Figure 3

QUICK START PROCEDURE

Demonstration circuit DC2681A-A is an easy way to evaluate the performance of the LTM4645EY. 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:

MODE	RUN
CCM	ON

2. With power off, connect the input power supply, load 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 should be 1.0V \pm 1.0% (0.99V to 1.01V).

4. Vary the input voltage from 6V to 15V and adjust the load current from 0A-25A. 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.
6. (Optional) LTM4645 can be synchronized to an external clock signal. Place the JP1 jumper on EXT_CLK and apply a clock signal (0V to 5V, square wave) on the MODE_PLLIN test point.

QUICK START PROCEDURE

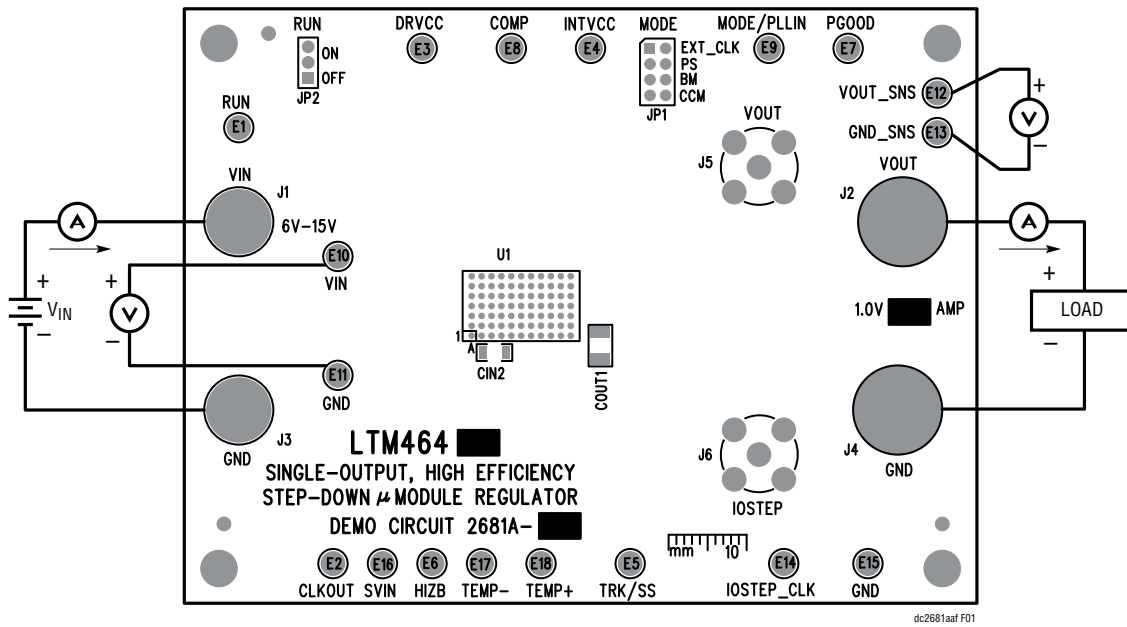


Figure 1. Measurement Setup of DC2681A-A

QUICK START PROCEDURE

12V_{IN}, 600kHz Efficiency Sweeps

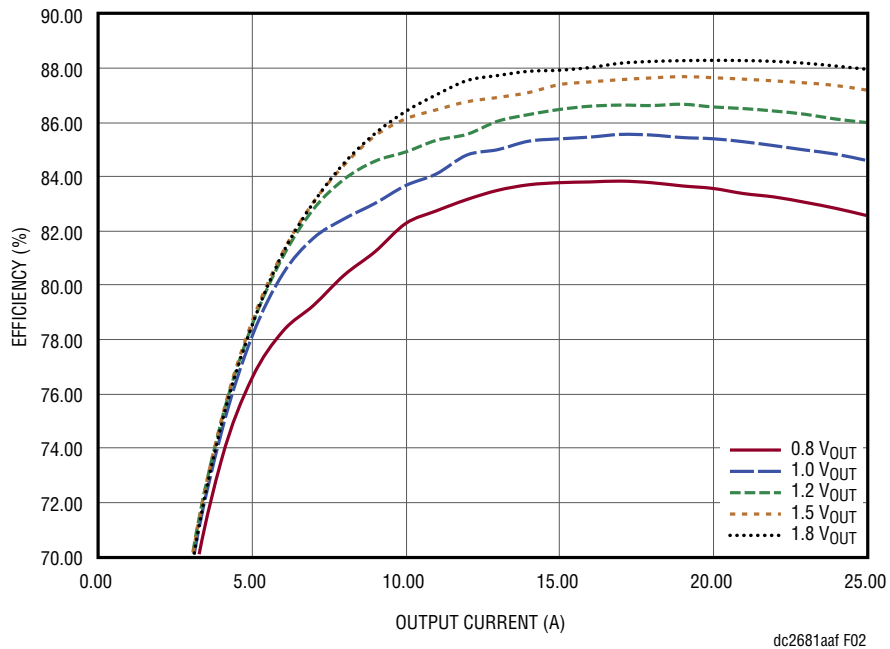


Figure 2. Measured Efficiency at V_{IN} = 12.0V, f_{SW} = 600kHz, CCM

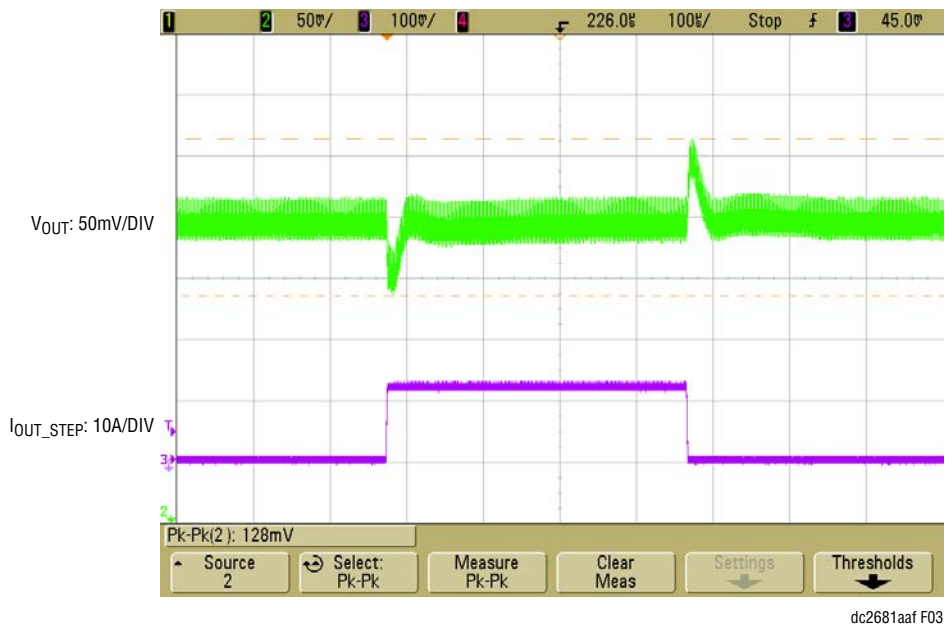


Figure 3. Measured Load Transient

QUICK START PROCEDURE

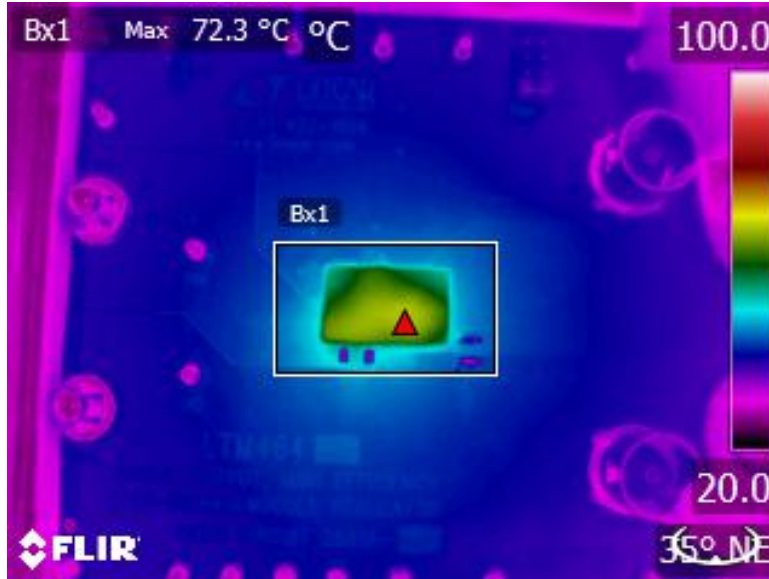


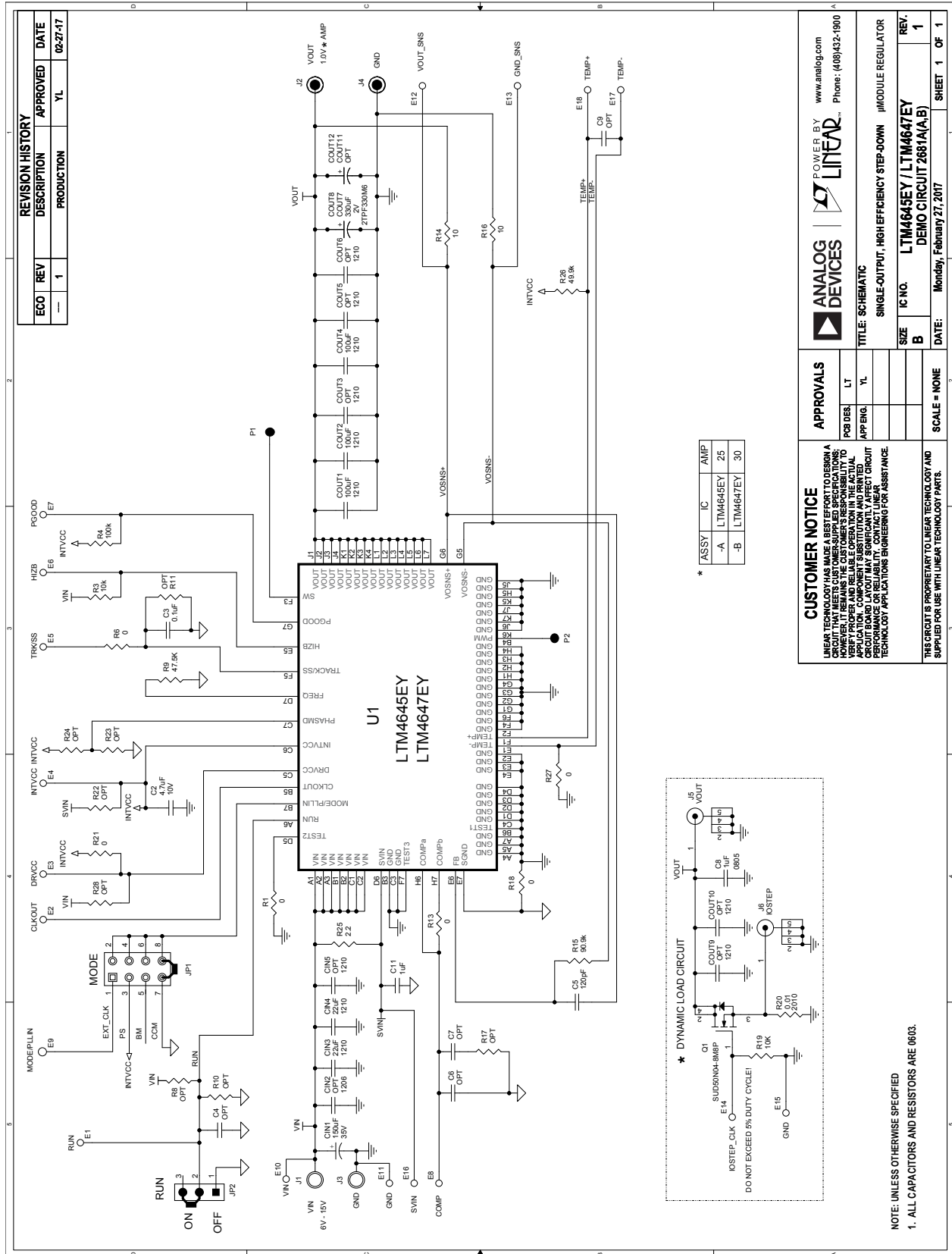
Figure 4. Thermal Image of LTM4645
 $V_{IN} = 12V$, $V_{OUT} = 1.0V$, $I_{LOAD} = 25A$
Ambient Temperature = 25.0°C, No Forced Air Flow

DEMO MANUAL DC2681A-A

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	CIN1	CAP., ALUM., 150µF, 35V, 20%, HVH	SUN ELECTRONIC INDUSTRIES CORP, 35HVH150MT
2	3	CIN3, CIN4	CAP., 22µF, X5R, 25V, 20%, 1210	MURATA, GRM32ER61E226ME15L
3	3	COUT1, COUT2, COUT4	CAP., 100µF, X5R, 6.3V, 20%, 1210	MURATA, GRM32ER60J107ME20L
4	2	COUT7, COUT8	CAP., POSCAP, 330µF, 2V, D2E	PANASONIC, 2TPF330M6
5	1	C2	CAP., 4.7µF, X5R, 10V, 10%, 0603	AVX, 0603ZD475KAT2A
6	1	C3	CAP., 0.1µF, X7R, 16V, 10%, 0603	AVX, 0603YC104KAT2A
7	1	C5	CAP., 120pF, X7R, 50V, 10%, 0603	YAGEO, CC0603KRX7R9BB121
8	1	C8	CAP., 1µF, X7R, 50V, 10%, 0805	MURATA, GRM21BR71H105KA12L
9	1	C11	CAP., 1µF, X7R, 50V, 10%, 0603	TAIYO YUDEN, UMK107AB7105KA-T
10	1	Q1	XSTR., MOSFET, N-CH, 40V, TO-252	VISHAY, SUD50N04-8M8P-4GE3
11	2	R3, R19	RES., 10k, 1/10W, 1%, 0603	VISHAY, CRCW060310K0FKEA
12	1	R4	RES., 100k, 1/10W, 1%, 0603	VISHAY, CRCW0603100KFKEA
13	1	R9	RES., 47.5k, 1/10W, 1%, 0603	VISHAY, CRCW060347K5FKEA
14	2	R14, R16	RES., 10Ω, 1/10W, 5%, 0603	VISHAY, CRCW060310R0JNEA
15	1	R15	RES., 90.9k, 1/10W, 1%, 0603	VISHAY, CRCW060390K9FKEA
16	1	R20	RES., SENSE, 0.01Ω, 1/2W, 1%, 2010	VISHAY, WSL2010R0100FEA
17	1	R25	RES., 2.2Ω, 1/10W, 5%, 0603	VISHAY, CRCW06032R2JNEA
18	1	R26	RES., 50k, 1/10W, 1%, 0603	VISHAY, CRCW060350K0FKEA
19	1	U1	IC, LTM4645EY#PBF BGA77-15x9-5.01	ANALOG DEVICES, LTM4645EY#PBF
Additional Demo Board Circuit Components				
1	0	CIN2	CAP., OPTION, 1206	MURATA, GRM31CR6YA106KA12L
2	0	CIN5, COUT3, COUT5, COUT6, COUT9, COUT10	CAP., OPTION, 1210	OPT
3	0	COUT11, COUT12	CAP., OPTION, D3L	OPT
4	0	C4, C6, C7, C9	CAP., OPTION, 0603	OPT
5	6	R1, R6, R13, R18, R21, R27	RES., 0Ω, 1/10W, 0603	VISHAY, CRCW06030000Z0EA
6	0	R8, R10, R11, R17, R22, R23, R24, R28	RES., OPTION, 0603	OPT
Hardware: For Demo Board Only				
1	18	E1-E18	TESTPOINT, TURRET, .062"	MILL-MAX, 2308-2-00-80-00-00-07-0
2	1	JP1	CONN., HEADER, 2x4, 2mm	SULLINS, NRPNO42PAEN-RC
3	1	JP2	CONN., HEADER, 1x3, 2mm	SULLINS, NRPNO31PAEN-RC
4	2	J1, J3	CONN., BANANA JACK	KEYSTONE, 575-4
5	2	J2, J4	STUD, TESTPIN	PEM, KFH-032-10
6	4	J2, J4 (x2)	NUT, BRASS 10-32	ANY, #10-32M/S BR PL
7	2	J2, J4	RING, LUG #10	KEYSTONE, 8205
8	2	J2, J4	WASHER, TIN PLATED BRASS	ANY, #10 EXT BZ TN
9	2	J5, J6	CONN, BNC, 5 PINS	CONNEX, 112404
10	2	XJP1, XJP2	SHUNT, 2mm	SAMTEC, 2SN-BK-G
11	4	MTGS. at 4 CORNERS	STAND-OFF, NYLON, SNAP-ON, 0.50" TALL	KEYSTONE, 8833 (SNAP ON)

SCHEMATIC DIAGRAM



REVISION HISTORY				
ECO	REV	DESCRIPTION	APPROVED	DATE
—	1	PRODUCTION	YL	02-27-17

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APPROVALS

PCB DES.	LT
APP ENG.	YL

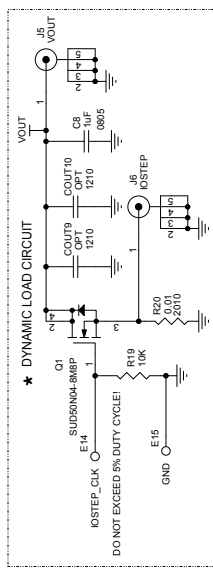
TITLE: SCHEMATIC
SINGLE-OUTPUT, HIGH EFFICIENCY STEP-DOWN μMODULE REGULATOR

SIZE	IC NO.	LTM4645EY / LTM4647EY	REV.
B		DEMO CIRCUIT 2681A(A,B)	1

DATE: Monday, February 27, 2017

SCALE = NONE

SHEET 1 OF 1



NOTE: UNLESS OTHERWISE SPECIFIED
 1. ALL CAPACITORS AND RESISTORS ARE 0603.



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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