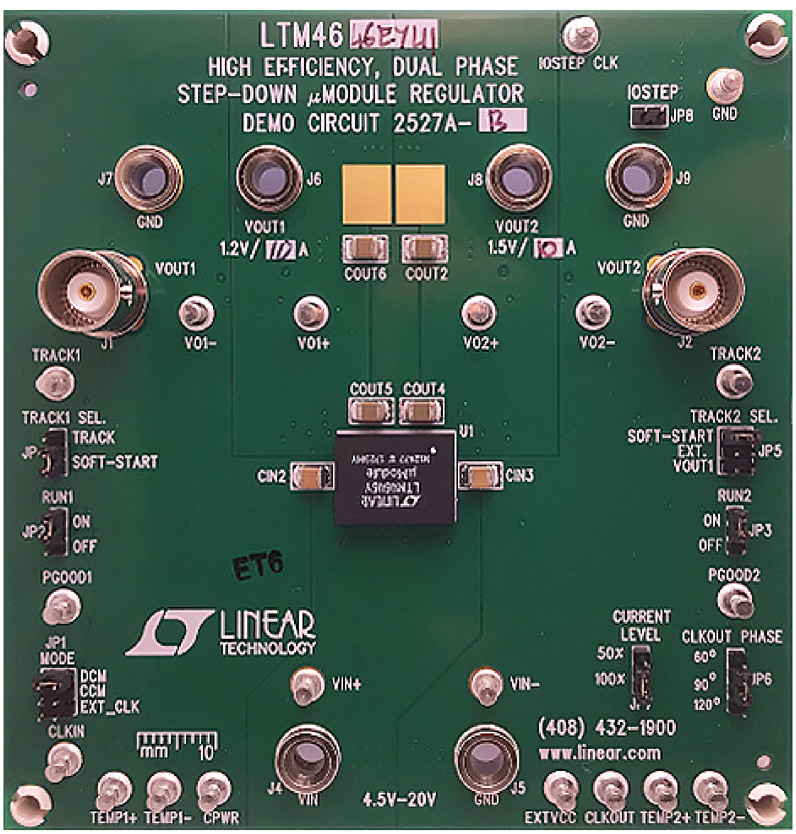
LTM4646
Dual 10A or Single 20A μModule Regulator

DESCRIPTION

Demonstration circuit 2527A-B features the LTM®4646EY, a dual 10A or single 20A high efficiency, switch mode step-down power μModule regulator. The input voltage range is from 4.5V to 20V. With CPWR bias, input voltage can be as low as 2.375V. The output voltage range is 0.6V to 5.5V. De-rating is necessary for certain V_{IN}, V_{OUT}, frequency and thermal conditions. The DC2527A-B offers the TRACK/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 can select discontinuous conduction mode. The MODE_PLLIN pin also allows the LTM4646 to synchronize to an external clock signal (between 300kHz and 1.3MHz). DC2527A-B has the option of choosing both internal and external compensation circuit for LTM4646. Tying the PHASMD pin to different pins generates certain phases of CLKOUT and Channel2. The LTM4646 data sheet must be read in conjunction with this demo manual prior to working on or modifying demo circuit DC2527A-B.

Design files for this circuit board are available at http://www.linear.com/demo/DC2527A-B

BOARD PHOTO



PERFORMANCE SUMMARY

PARAMETER	CONDITIONS	VALUE
Input Voltage Range		4.5V to 20V
Output Voltages		1.2V, 1.5V ± 1.5%
Maximum Continuous Output Current	De-rating is Necessary for Certain Operating Conditions. See Data Sheet for Details	$10A_{DC}$ for Each Channel
Operating Frequency		350kHz
Efficiency of Channel 1	V_{IN} = 12V, V_{OUT1} = 1.2V, I_{OUT1} = 10A	86.75% See Figure 2
Efficiency of Channel 2	V_{IN} = 12V, V_{OUT2} = 1.5V, I_{OUT2} = 10A	87.73% See Figure 3
Load Transient of Channel 1	V_{IN} = 12V, V_{OUT1} = 1.2V, I_{STEP} = 0A to 5A	95mV See Figure 4
Load Transient of Channel 2	V_{IN} = 12V, V_{OUT2} = 1.5V, I_{STEP} = 0A to 5A	111mV See Figure 5

QUICK START PROCEDURE

Demonstration circuit DC2527A-B is an easy way to evaluate the performance of the LTM4646EY. 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	RUN1	RUN2
CCM	ON	ON

TRACK1	TRACK2	CLKOUT PHASE	CURRENT LEVEL
SOFT-START	SOFT-START	90°	100%

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 of Channel 1 should be 1.2V ± 1.5% (1.182V to 1.218V). The output voltage of Channel 2 should be 1.5V ± 1.5% (1.478V to 1.522V).

4. Vary the input voltage from 4.5V to 20V and adjust the load current of each channel from 0A-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 R34, R35 (on the backside of boards) to apply load transient on channel 1, channel 2 correspondingly.

6. (Optional) LTM4646 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 CLKIN test point.

7. (Optional) The outputs of LTM4646 can track another supply. If tracking external voltage is selected, the corresponding test points, TRACK1, TRACK2, 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 DC2527A. Install 0Ω resistors on R39 and R17.

QUICK START PROCEDURE

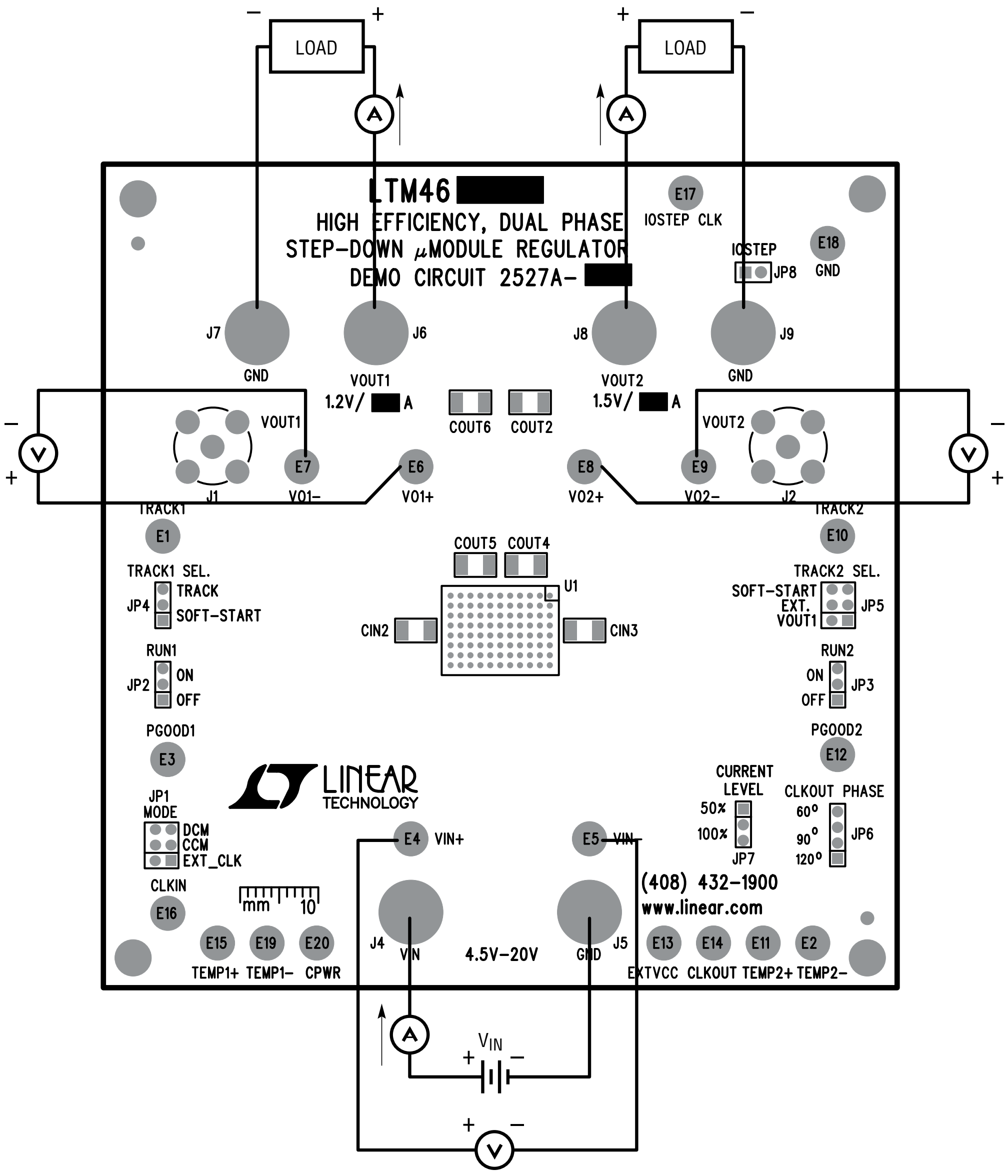


Figure 1. Measurement Setup of DC2527A

QUICK START PROCEDURE

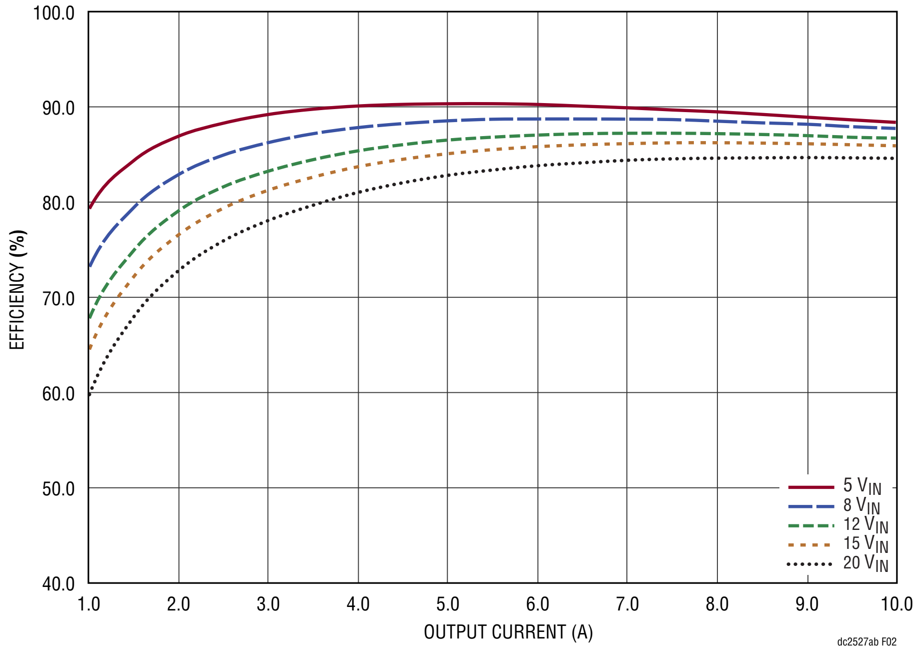


Figure 2. Measured Efficiency of Channel 1 at V_{OUT1} = 1.2V, f_{SW} = 350kHz, CCM

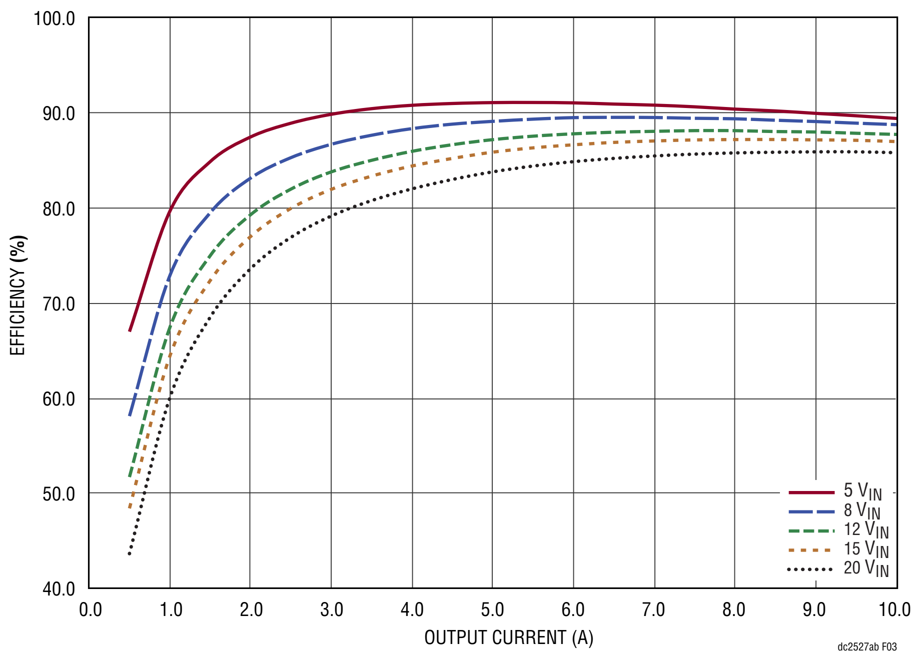


Figure 3. Measured Efficiency of Channel 2 at V_{OUT2} = 1.5V, f_{SW} = 350kHz, CCM

QUICK START PROCEDURE

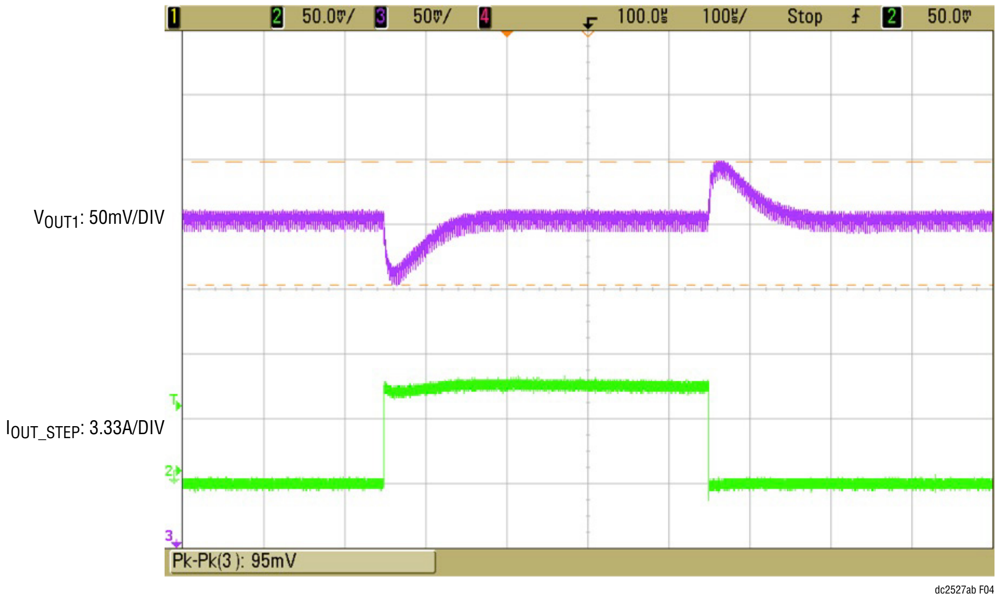


Figure 4. Measured Load Transient
V_{IN} = 12V, V_{OUT1} = 1.2V, I_{STEP} = 0A to 5A

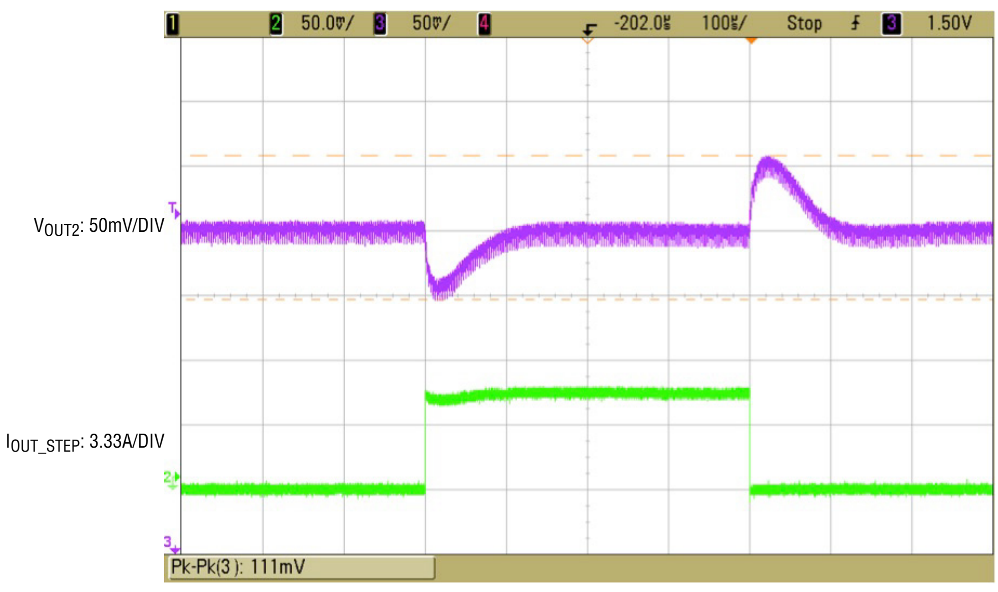


Figure 5. Measured Load Transient
V_{IN} = 12V, V_{OUT2} = 1.5V, I_{STEP} = 0A to 5A

QUICK START PROCEDURE

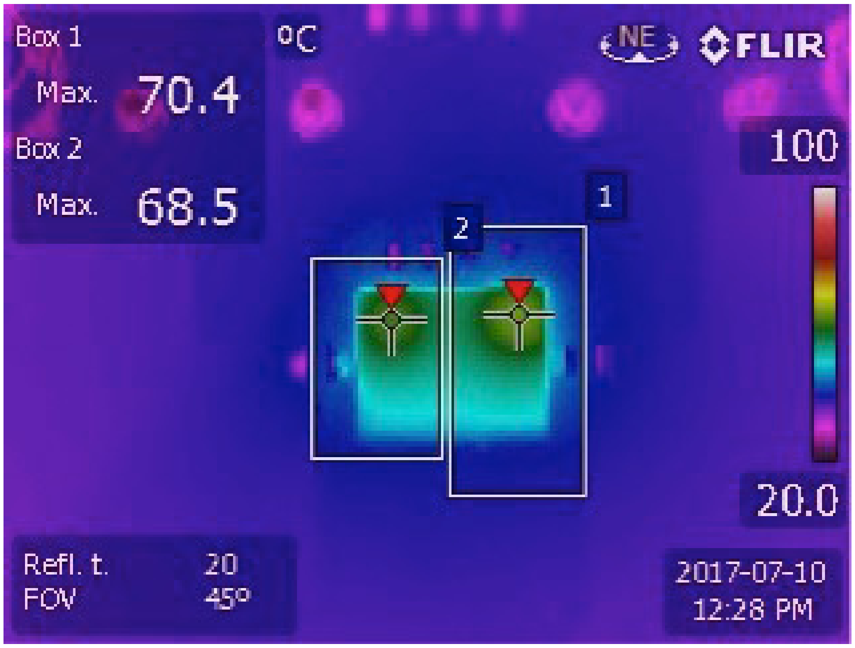
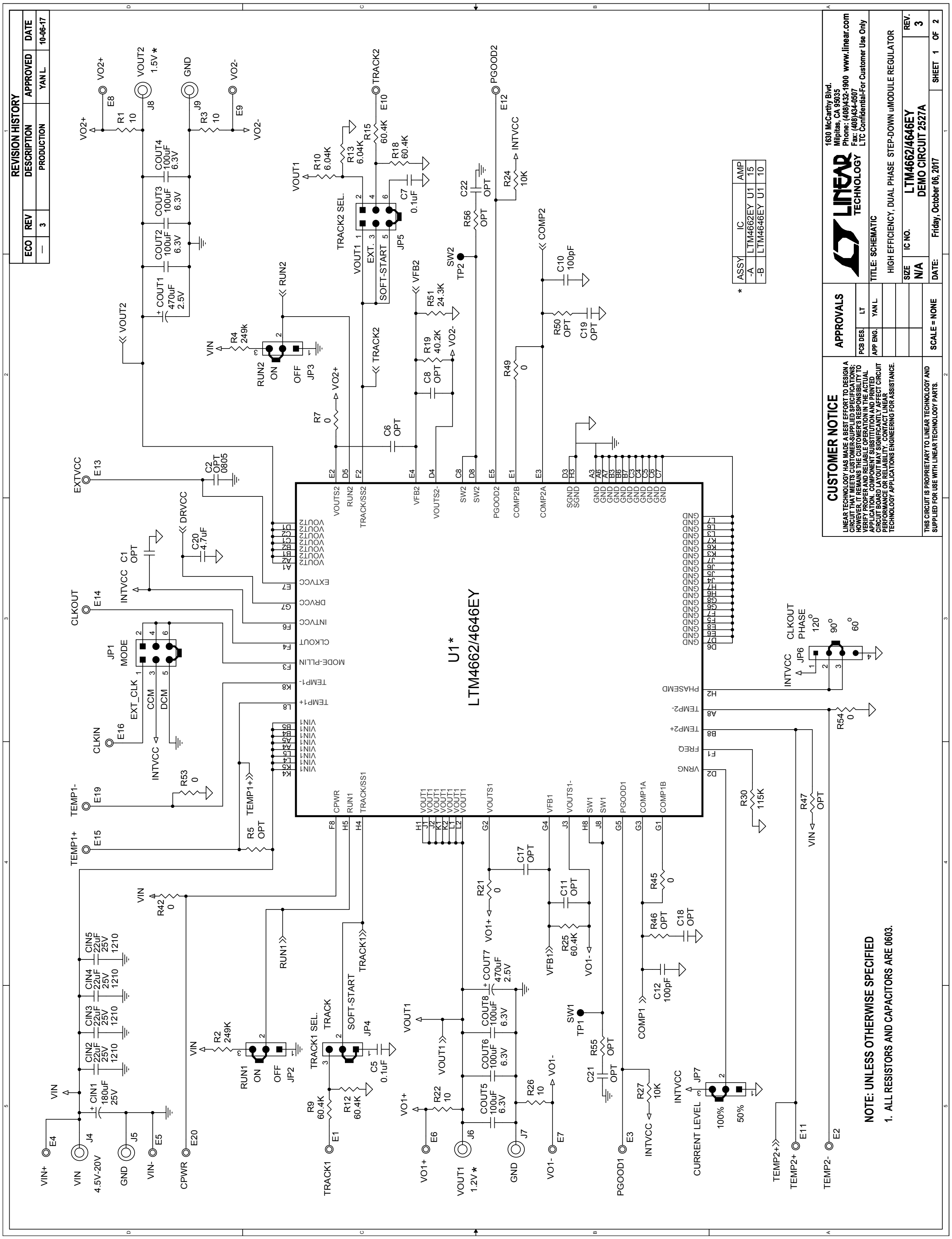


Figure 6. Thermal Image of LTM4646
V_{IN} = 12V, V_{OUT1} = 1.2V, I_{LOAD1} = 10A, V_{OUT2} = 1.5V, I_{LOAD2} = 10A
Ambient Temperature = 25.0°C, No Forced Air Flow

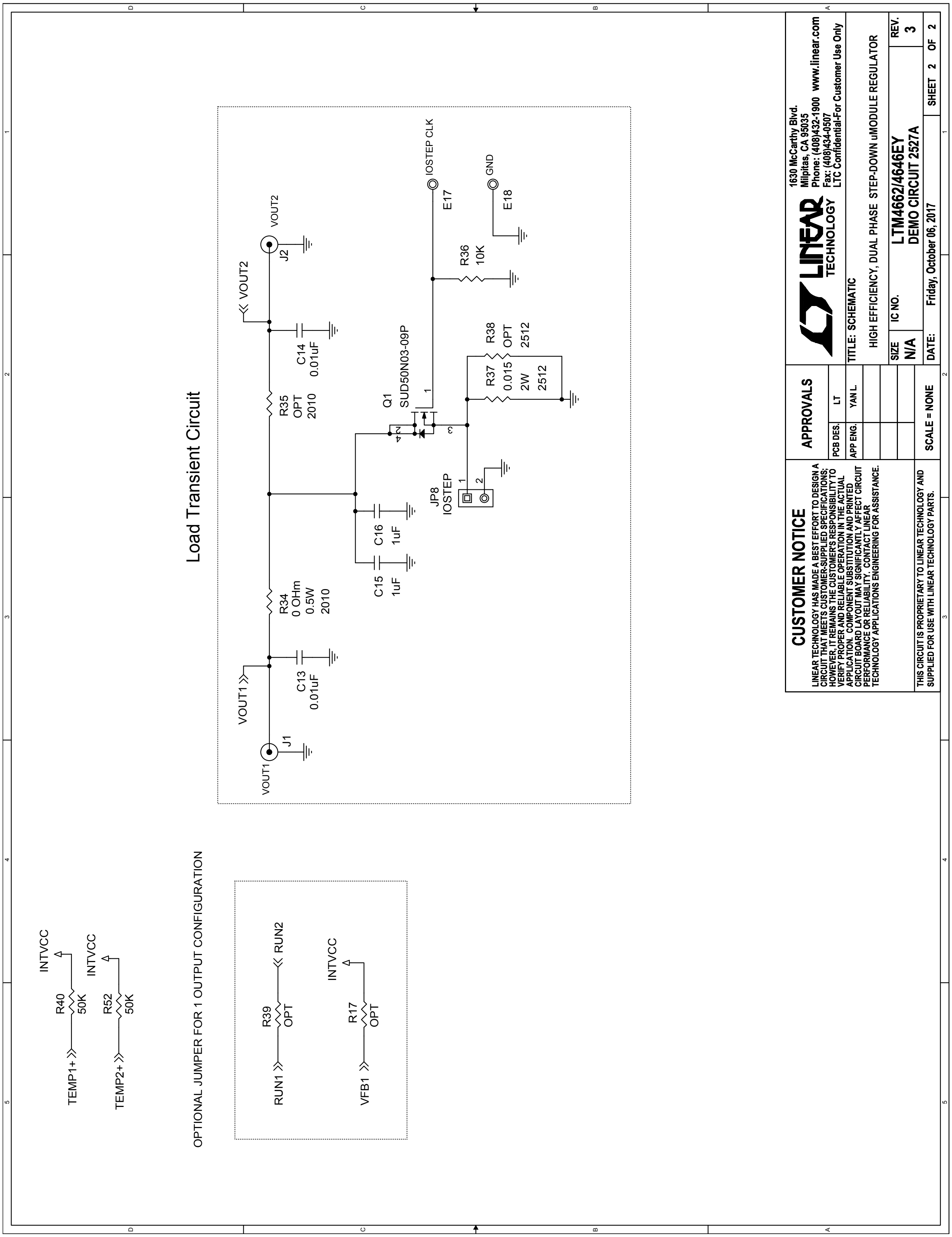
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	CIN1	CAP., 180µF, 25V, OS-CON 8 × 11.9	PANASONIC, 25SVPF180M
2	4	CIN2, CIN3, CIN4, CIN5	CAP., X5R, 22µF, 25V, 10%,1210	MURATA, GRM32ER61E226KE15L
3	2	COUT1, COUT7	CAP., 470µF, 2.5V, POSCAP, D3L	PANASONIC, ETPF470M5H
4	6	COUT2, COUT3, COUT4, COUT5, COUT6, COUT8	CAP., X5R, 100µF, 6.3V, 20%,1210	AVX, 12106D107MAT2A
5	2	C5, C7	CAP., X5R, 0.1µF, 25V, 10%, 0603	AVX, 06033D104KAT2A
6	2	C10, C12	CAP., C0G, 100pF, 50V, 1%, 0603	AVX, 06035A101FAT2A
7	1	C20	CAP., X5R, 4.7µF, 10V,10%, 0603	TDK, CGB3B1X5R1A475K055AC
8	4	R1, R3, R22, R26	RES., 10Ω, 1%, 0603	NIC, NRC06F10R0TRF
9	2	R2, R4	RES., 249k, 1%, 0603	VISHAY,CRCW0603249KFKEA
10	5	R9, R12, R15, R18, R25	RES., 60.4k, 1%, 0603	VISHAY, CRCW060360K4FKEA
11	2	R10, R13	RES., 6.04k, 1%, 0603	VISHAY, CRCW06036K04FKEA
12	1	R19	RES., 40.2k, 1%, 0603	VISHAY,CRCW060340K2FKEA
13	3	R24, R27, R36	RES., 10k, 1%, 0603	VISHAY, CRCW060310K0FKEA
14	1	R30	RES., 115k, 1%, 0603	VISHAY,CRCW0603115KFKEA
15	2	R40, R52	RES., 49.9k, 1/10W, 1%, 0603	VISHAY CRCW060349K9FKEA
16	1	R51	RES., 24.3k, 1%, 0603	VISHAY, CRCW060324K3FKEA
17	1	U1	IC, LTM4646EY, BGA88-15 × 11.25-6.01	LINEAR TECH. LTM4646EY#PBF
Additional Demo Board Circuit Components				
1	0	C1, C2	CAP., OPT, 0805	OPT
2	0	C6, C8, C11, C17, C18, C19, C21, C22	CAP., OPT, 0603	OPT
3	1	Q1	XSTR, N-CH 40V 14A TO-252	VISHAY SUD50N04-8M8P-4GE3
4	0	R5, R17, R39, R46, R47, R50, R55, R56	RES., OPT, 0603	OPT
5	7	R7, R21, R42, R45, R49, R53, R54	RES., 0, 1%, 0603	VISHAY, CRCW06030000Z0EA
6	1	R34	RES., 0Ω, 1/2W, 2010	VISHAY, CRCW20100000Z0EF
7	0	R35	RES., OPT, 2010	OPT
8	1	R37	RES., 0.015Ω, 2W, 2512	VISHAY, WSL2512R0150FEA
9	0	R38	RES., OPT, 2512	OPT
10	2	C13, C14	CAP., X5R, 0.01µF, 50V, 10%, 0603	AVX,06035C103KAT2A
11	2	C15, C16	CAP., X7R, 1µF, 10V, 10%, 0603	AVX, 0603ZC105KAT2A
Hardware: For Demo Board Only				
1	20	E1-E20	TESTPOINT, TURRET, .094" PBF	MILL-MAX, 2501-2-00-80-00-00-07-0
2	2	JP1, JP5	CONN., HEADER, 2 × 3, 2mm	WURTH ELEKTRONIK, 62000621121
3	4	JP2, JP3, JP4, JP7	CONN., HEADER, 1 × 3, 2mm	WURTH ELEKTRONIK, 62000821121
4	1	JP6	CONN., HEADER, 1 × 4, 2mm	WURTH ELEKTRONIK, 62000411121
5	1	JP8	CONN., HEADER, 1 × 2, 2mm	WURTH ELEKTRONIK, 62000211121
6	7	XJP1-XJP7	SHUNT, 2mm	WURTH ELEKTRONIK, 60800213421
7	2	J1, J2	CONN, BNC, 5 PINS	CONNEX, 112404
8	6	J4-J9	JACK BANANA	KEYSTONE, 575-4
9	4	(STAND-OFF)	STAND-OFF, SNAP ON NYLON 0.50" TALL	KEYSTONE, 8833(SNAP ON)

SCHEMATIC DIAGRAM



SCHEMATIC DIAGRAM



dc2527abf

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.

Legal Terms and Conditions

LT 1217 • PRINTED IN USA