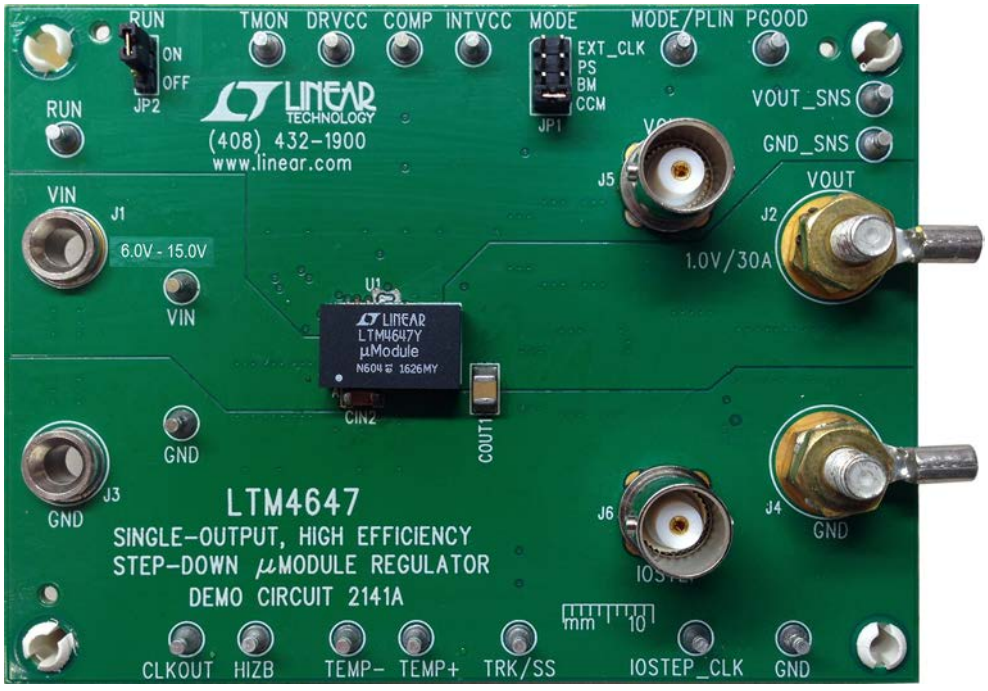
LTM4647
30A DC/DC Step-Down µModule Regulator

DESCRIPTION

Demonstration circuit 2141A features the LTM®4647EY, a 30A high efficiency, switch mode step-down power µModule regulator. The input voltage range is from 6V to 15V. To use DC2141A for input voltage range from 4.7V to 6V, connect INTVCC to SVIN (change R22 from OPT to 0Ω), DRVCC to VIN (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 VIN, VOUT, frequency and thermal conditions. The DC2141A 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 LTM4647 to synchronize to an external clock signal (between 400kHz and 800kHz). DC2141A has the option of choosing both internal and external compensation circuit for LTM4647. Tying the PHASMD pin to different voltage generates certain phase difference between MODE_PLLIN and CLKOUT. The LTM4647 data sheet must be read in conjunction with this demo manual prior to working on or modifying demo circuit DC2141A.

Design files for this circuit board are available at http://www.linear.com/demo/DC2141A

BOARD PHOTO



PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range		6		15	V
Output Voltages	R_{FB} = 90.9kΩ		1.0 ±1.0%		V
Maximum Continuous Output Current	Derating Is Necessary for Certain Operating Conditions. See Data Sheet for Details		30		ADC
Operating Frequency	R_{FREQ} = 47.5kΩ		600		kHz
Efficiency	V_{IN} = 12V, V_{OUT} = 1.0V, I_{OUT} = 30A		86.2 Figure 2		%
Load Transient	V_{IN} = 12V, V_{OUT} = 1.0V, I_{STEP} = 5A to 20A		153 Figure 3		mV

QUICK START PROCEDURE

Demonstration circuit 2141A is an easy way to evaluate the performance of the LTM4647EY. 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 ±1.0% (0.99V to 1.01V).
4. Vary the input voltage from 6V to 15V and adjust the load current from 0A to 30A. 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) LTM4647 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

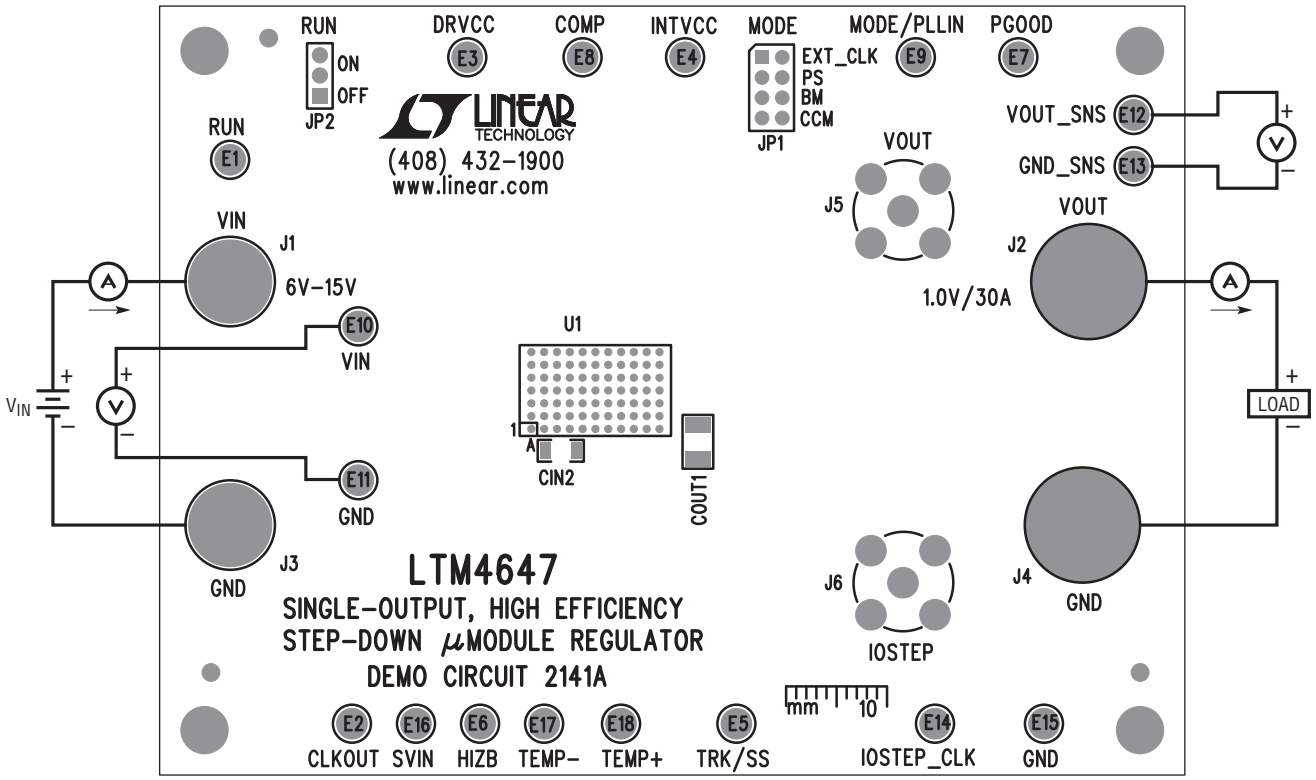


Figure 1. Measurement Set-Up of DC2141A

QUICK START PROCEDURE

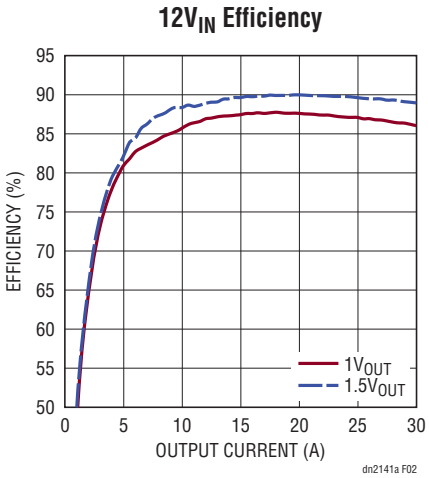


Figure 2. Measured Efficiency at V_{IN} = 12.0V, f_{SW} = 600kHz, CCM

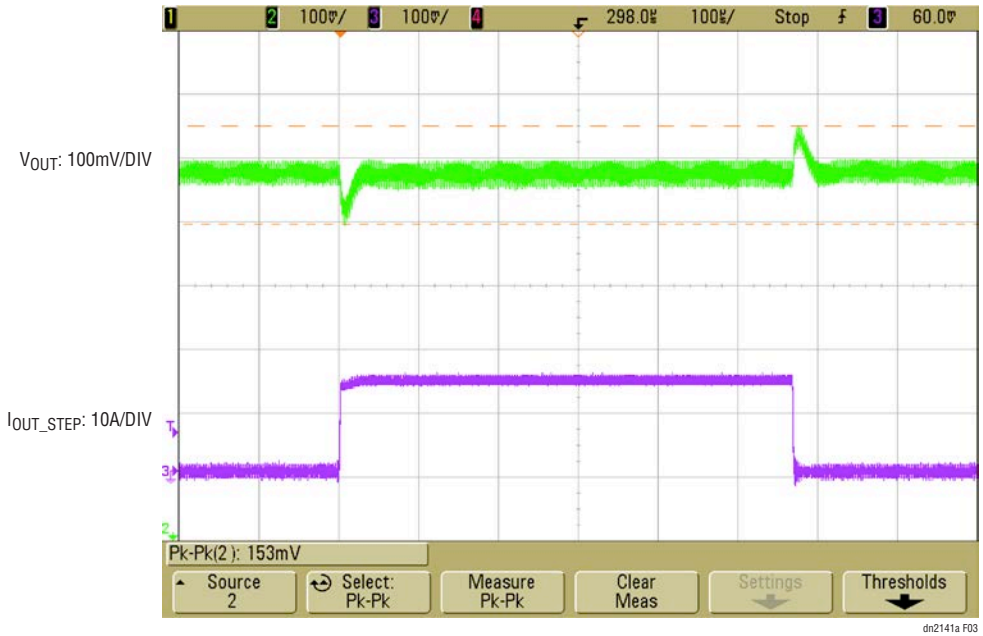


Figure 3. Measured Load Transient, V_{IN} = 12V, V_{OUT1} = 1.0V, I_{STEP} = 5A to 20A

QUICK START PROCEDURE

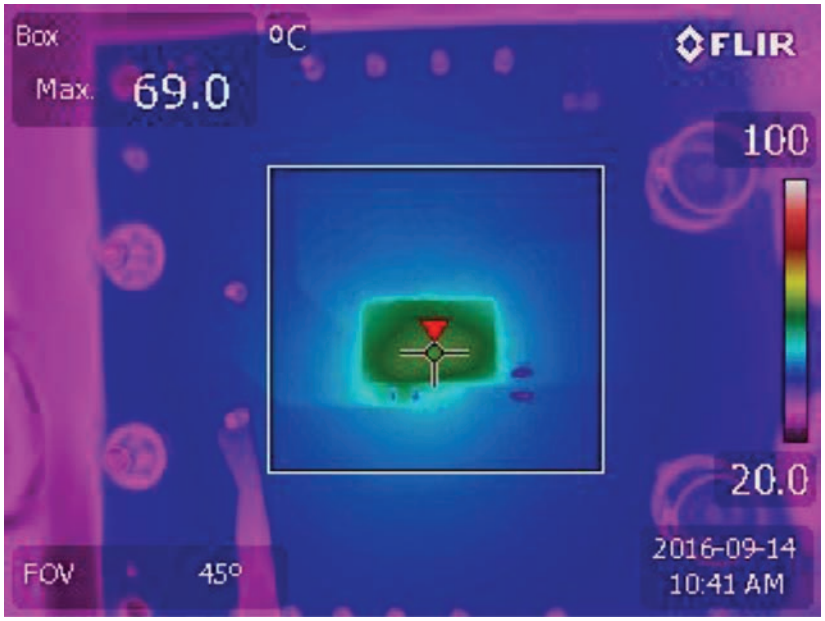
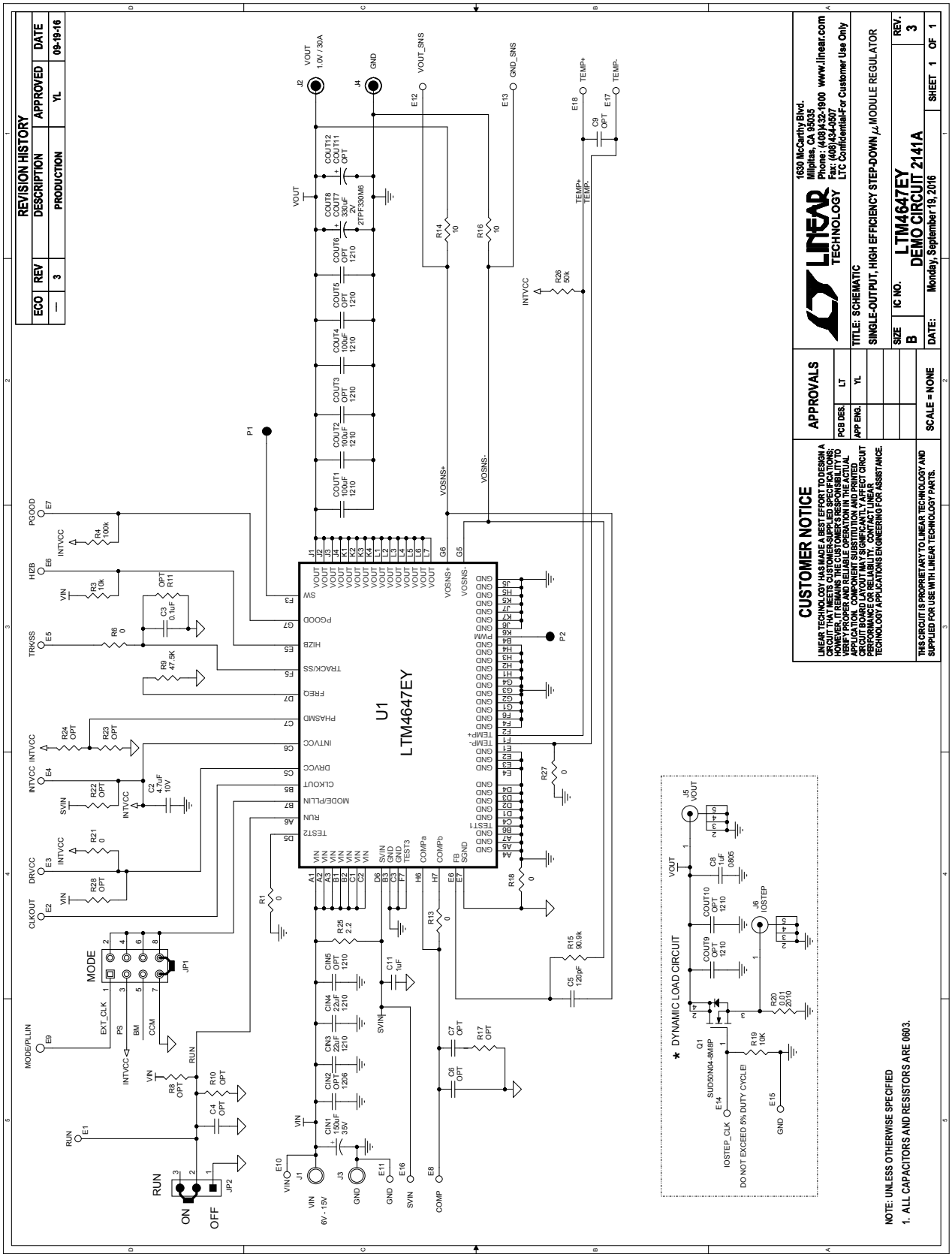


Figure 4. Thermal Image of LTM4647, V_{IN} = 12V, V_{OUT} = 1.0V, I_{LOAD} = 30A, T_A = 23.0°C, No Forced Air Flow

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, LTM4647EY#PBF BGA77-15X9-5.01	LINEAR TECH., LTM4647EY#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, 0.062"	MILL-MAX, 2308-2-00-80-00-00-07-0
2	1	JP1	CONN., HEADER, 2X4, 2mm	SULLINS, NRPN042PAEN-RC
3	1	JP2	CONN., HEADER, 1X3, 2mm	SULLINS, NRPN031PAEN-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, 5PINS	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



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This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

Mailing Address:

Linear Technology
1630 McCarthy Blvd.
Milpitas, CA 95035