LTC3866EUF
High Efficiency Step-Down Converter with Very Low DCR Inductor

DESCRIPTION

Demonstration circuit 1829A is a high efficiency, high density, synchronous buck converter with 4.5V to 14V input voltage range. It can supply a 30A maximum load current with a 1.5V output. This demo board utilizes the LTC®3866EUF, a feature-rich single phase synchronous buck controller with very low DCR current sensing capability, on-chip drivers and remote output voltage sensing. This board is setup with 0.32mΩ DCR inductor. The temperature compensation function guarantees accurate current limit over a wide temperature range with DCR sensing.

The LTC3866 is suitable for operation from an input voltage of 4.5V to 38V and output voltages up to 3.5V. It can provide high efficiency, high power density and versatile power solutions for telecom and datacom systems, industrial and medical instruments, along with DC power distribution systems and computer systems. The LTC3866 is available in 24-pin 4mm × 4mm QFN and 24-lead FE packages.

To shut down the converter, set the RUN pin voltage below 1.2V (JP2: OFF). Use JP1 jumper to select Burst Mode® operation, pulse skipping mode or forced continuous mode operation at light load. Switching frequency is preset at about 400kHz, and it can be easily modified from 250kHz to 770kHz. Onboard dynamic circuit is also available for transient test. Please see LTC3866 data sheet for more detailed information.

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

PERFORMANCE SUMMARY (T_A = 25°C)

PARAMETER	CONDITION	VALUE
Input Voltage Range		4.5V to 14V
Output Voltage, V_{OUT}	V_{IN} = 4.5V to 14V, I_{OUT} = 0A to 30A	1.5V ±2%
Maximum Output Current, I_{OUT}	V_{IN} = 4.5V to 14V, V_{OUT} = 1.5V	30A
Typical Efficiency	V_{IN} = 12V, V_{OUT} = 1.5V, I_{OUT} = 30A	90.3%
Typical Switching Frequency		400kHz

QUICK START PROCEDURE

Demonstration circuit 1829A is easy to set up to evaluate the performance of the LTC3866EUF. Refer to Figure 1 for the proper measurement equipment setup and follow the procedure below:

1. With power off, connect the input power supply to V_{IN} (4.5V to 14V) and GND (input return).
2. Connect the 1.5V output load between V_{OUT} and GND (Initial load: no load).
3. Connect the DVMs to the input and outputs. Set default jumper position: JP1: CCM; JP2: ON.
4. Turn on the input power supply and check for the proper output voltages. V_{OUT} should be 1.5V ±2%.
5. Once the proper output voltages are established, adjust the loads within the operating range and observe the output voltage regulation, ripple voltage and other parameters.

Note: When measuring the output or input voltage ripple, do not use the long ground lead on the oscilloscope probe. See Figure 2 for the proper scope probe technique. Short, stiff leads need to be soldered to the (+) and (–) terminals of an output capacitor. The probe's ground ring needs to touch the (–) lead and the probe tip needs to touch the (+) lead.

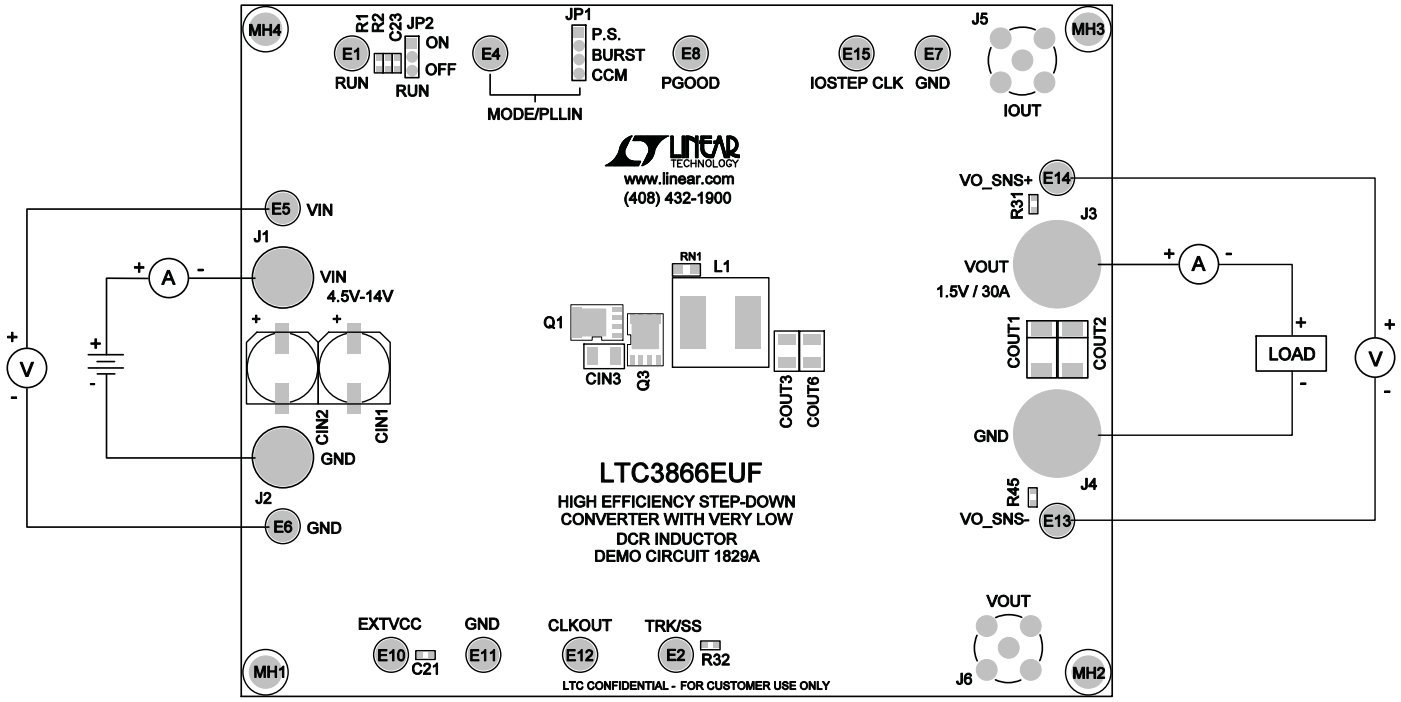


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

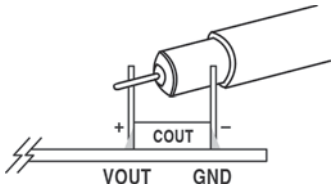


Figure 2. Measuring Output Voltage Ripple

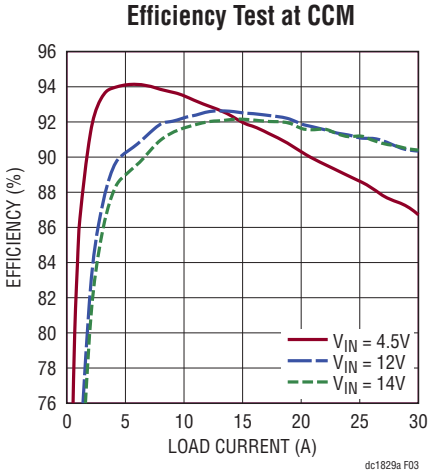


Figure 3. Efficiency vs Load Current

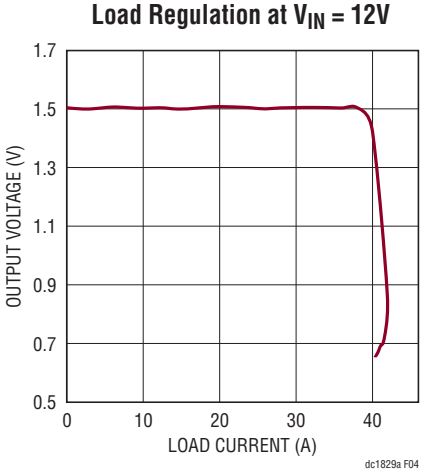


Figure 4. Output Voltage vs Load Current

QUICK START PROCEDURE

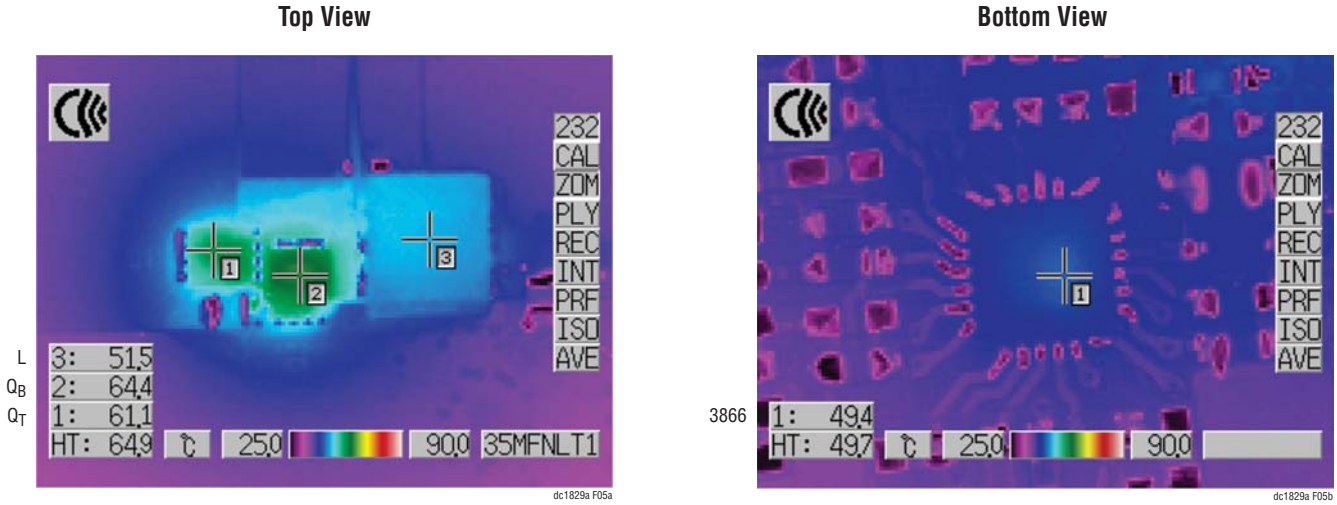


Figure 5. Thermal Performance at V_{IN} = 14V, V_O = 1.5V, I_O = 30A, No Forced Air, T_A = 25°C

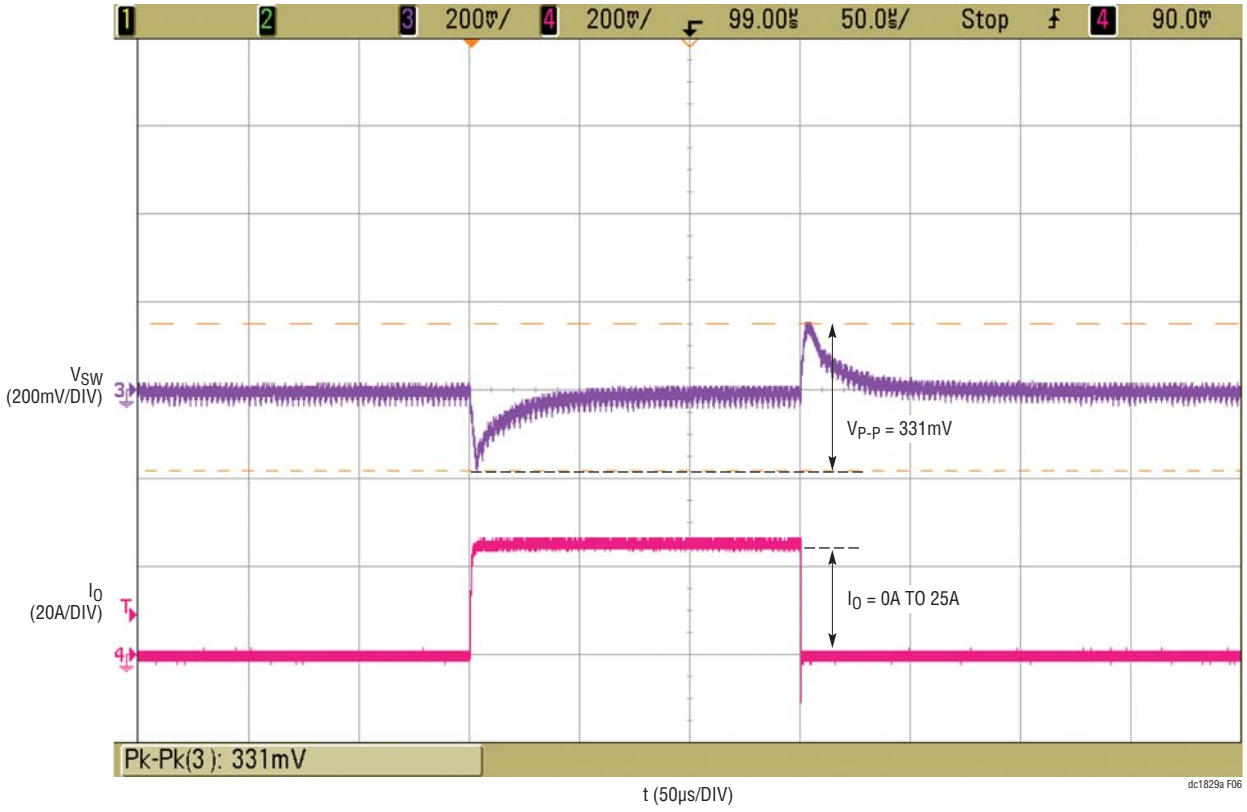


Figure 6. Transient Performance at V_{IN} = 12V, V_O = 1.5V, I_O = 0A ~ 25A

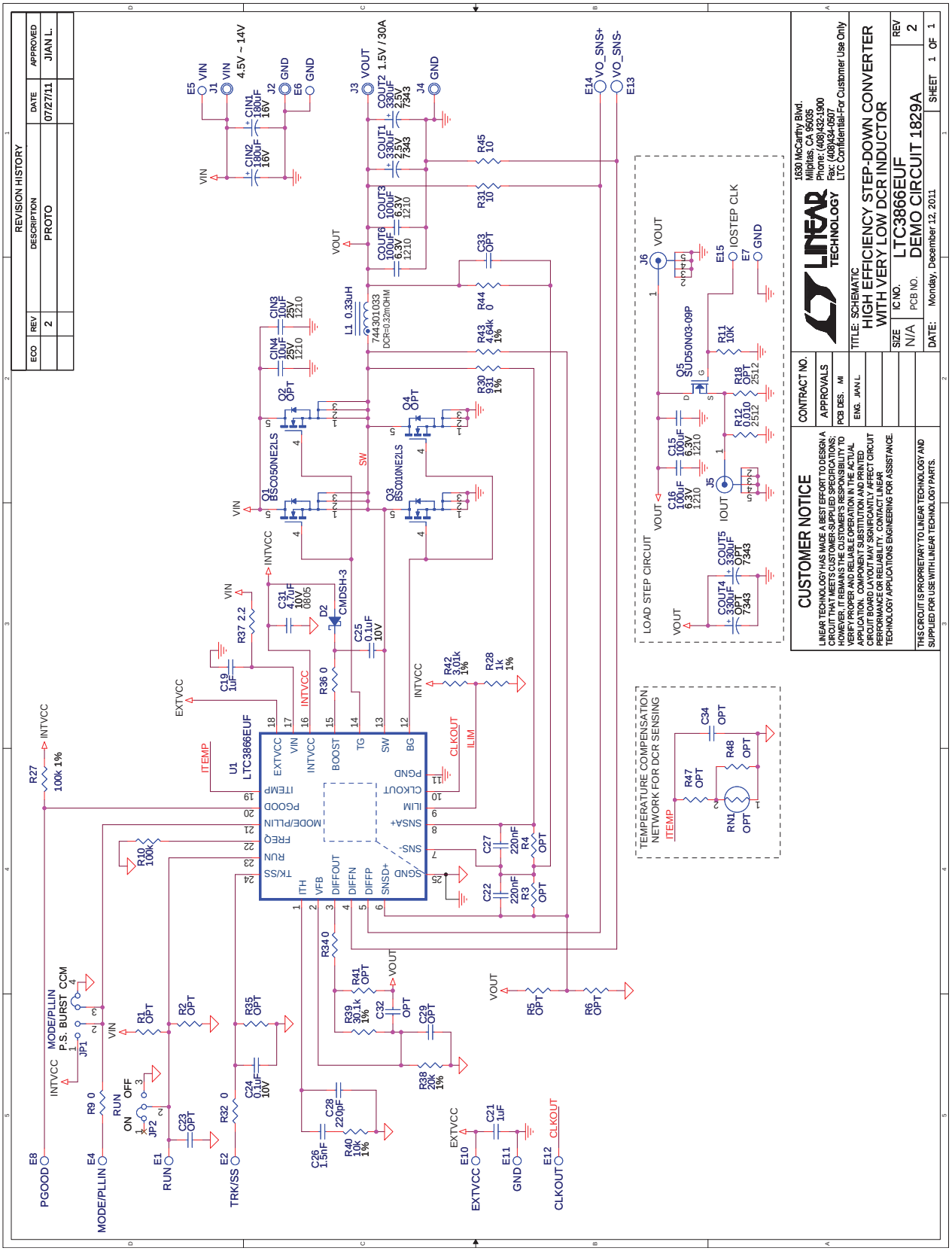
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	CIN1, CIN2	CAP, 180µF 20% 16V	SANYO 16SVP180MX
2	2	CIN3, CIN4	CAP, 1210 10µF 20% 25V X5R	TAIYO YUDEN TMK325BJ106MM-T
3	2	COUT1, COUT2	CAP, 7343 330µF 20% 2.5V POSCAP	SANYO 2R5TPE330M9
4	4	COUT3, COUT6, C15, C16	CAP, 1210 100µF 20% 6.3V X5R	TDK C3225X5R0J107M
5	2	C19, C21	CAP, 0603 1µF 10% 25V X5R	TAIYO YUDEN TMK107BJ105MA-T
6	2	C22, C27	CAP, 0603 220nF 10% 25V X7R	TDK C1608X7R1E224K
7	2	C24, C25	CAP, 0603 0.1µF 10% 10V X5R	AVX 0603ZD104KAT
8	1	C26	CAP, 0603 1.5nF 5% 50V C0G	MURATA GRM1885C1H152JA01D
9	1	C28	CAP, 0603 220pF 10% 25V NPO	AVX 06033A221KAT2A
10	1	C31	CAP, 0805 4.7µF 20% 10V X5R	TDK C2012X5R1A475M
11	1	D2	DOIDE, CMDSH-3	CENTRAL SEMI CMDSH-3
12	1	L1	IND, 0.33µH	WURTH ELEKTRONIK M744301033
13	1	Q1	XSTR, POWER MOSFET	INFINEON BSC050NE2LS
14	1	Q3	XSTR, POWER MOSFET	INFINEON BSC010NE2LS
15	1	Q5	XSTR, SUD50N03-09P MOSFET	SILICONIX SUD50N03-09P
16	5	R9, R32, R34, R36, R44	RES, 0603 0Ω JUMPER 1/10W	VISHAY CRC06030000Z0EA
17	1	R10	RES, 0603 100k 5% 1/10W	VISHAY CRCW0603100KJNEA
18	1	R11	RES, 0603 10k 5% 1/10W	VISHAY CRCE060310K0JNEA
19	1	R12	RES, 2512 0.010Ω 5% 1W	VISHAY WSL2512R0100FEA
20	1	R27	RES, 0603 100k 1% 1/10W	VISHAY CRCW0603100KFKEA
21	1	R28	RES, 0603 1k 1% 1/10W	VISHAY CRCW06031K00FKEA
22	1	R30	RES, 0603 931Ω 1% 1/10W	YAGEO RC0603FR-07931RL
23	2	R31, R45	RES, 0603 10Ω 5% 1/10W	VISHAY CRCW060310R0JNEA
24	1	R37	RES, 0603 2.2Ω 5% 1/10W	VISHAY CRCW06032R20JNEA
25	1	R38	RES, 0603 20k 1% 1/10W	VISHAY CRCW060320K0FKEA
26	1	R39	RES, 0603 30.1k 1% 1/10W	VISHAY CRCW060330K1FKEA
27	1	R40	RES, 0603 10k 1% 1/10W	VISHAY CRCW060310K0FKEA
28	1	R42	RES, 0603 3.01k 1% 1/10W	VISHAY CRCW06033K01FKEA
29	1	R43	RES, 0603 4.64k 1% 1/10W	VISHAY CRCW06034K64FKEA
30	1	U1	IC, STEP-DOWN CONVERTER	LINEAR TECH LTC3866EUF
Additional Demo Board Circuit Components				
1	0	COUT4, COUT5	CAP, 7343 330µF 20% 2.5V POSCAP OPTION	SANYO 2R5TPE330M9 OPTION
2	0	C23, C29, C32, C33, C34	CAP, 0603 OPTION	OPTION
3	0	Q2, Q4	XSTR, OPTION	OPTION
4	0	RN1	THERMISTOR, OPTION	OPTION
5	0	R1-R6, R35, R41, R47, R48	RES, 0603 OPTION	OPTION
6	0	R18	RES, 2512 OPTION	OPTION

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Hardware/Components (For Demo Board Only)				
1	13	E1, E2, E4-E8, E10-E15	TURRET	MILL-MAX 2501-2-00-80-00-00-07-0
2	1	JP1	HEADER, 4 PIN	SAMTEC TMM-104-02--L-S
3	1	JP2	HEADER, 3 PIN	SAMTEC TMM-103-02--L-S
4	2	J1, J2	JACK, BANANA	KEYSTONE 575-4
5	2	J3, J4	STUD, TEST PIN	PEM KFH-032-10
6	4	J3, J4	NUT, BRASS PL #10-32	ANY, #10-32M/S
7	2	J3, J4	RING, LUG RING #10	KEYSTONE, 8205
8	2	J3, J4	WASHER, TIN, PLATED BRASS	ANY
9	2	J5, J6	CONN, BNC, 5 PINS	CONNEX 112404
10	4	MH1, MH2, MH3, MH4	STANDOFF, SNAP ON	KEYSTONE_8833
11	2	JP1, JP2	SHUNT	SAMTEC 2SN-BK-G

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.

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