

QUICK START GUIDE FOR DEMONSTRATION CIRCUIT 438

TRIPLE PHASE, SINGLE OUTPUT STEP-DOWN CONVERTER

LTC3731CG

DESCRIPTION

Demonstration circuit 438 is a triple phase single output synchronous buck converter featuring the LTC®3731CG. This circuit can be used for desktop computers and servers, notebook computers and other high output current DC/DC converters. The output voltage can be configured for either 2.5V or 1.8V and the maximum load current is 60A. The input voltage range of DC438 is 9V to 14V.

The LTC3731CG requires a separate supply for its internal control circuits and for its gate drivers. DC438 is populated with a 5V LT1761 linear regulator for this purpose. To obtain a higher

bias/gate drive supply voltage, the user can apply an external DC source to the “+5V” terminal on DC438. The maximum voltage for this input is 7.0V.

DC438 also features an on-board high di/dt dynamic load circuit to measure the load step response. Refer to the “Dynamic Load Testing” section for operating instructions.

Design files for this circuit board are available. Call the LTC factory.

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Table 1. Performance Summary

PARAMETER	CONDITION	VALUE
Minimum Input Voltage		9V
Maximum Input Voltage		14V
V _{OUT}	V _{IN} = 9V to 14V, I _{OUT} = 0A to 60A	2.5V ± 3% 1.8V ± 3%
Airflow	100% load	≥100 LFM

QUICK START PROCEDURE

Demonstration circuit 438 is easy to set up to evaluate the performance of the LTC3731CG. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. With power off, connect the input voltage source and the load. The input cables should be sized for 20A and the load cables should be sized for 60A.
2. If an external bias supply is connected to “+5V”, then the “5V SELECT” jumper should be in the “EXT” position. The external bias supply should be able to supply at least 100mA.
3. The jumpers should be in their default positions as shown in Figure 1.
4. If a constant current load is used, preset the load current to about 5A or less before applying power to the input. Otherwise, the foldback current limit function of the LTC3731 will be triggered during startup.
5. Apply power to the input and set the input voltage to 12V. The output voltage should be 2.5V ± 3%. Increase the load to 60A. The output voltage should still be within regulation.
6. Keep the input voltage at 12.0V and the load at 60A. Measure the DC input current. It should be less than 15.2A.
7. Remove input power from the converter. Set the voltage to 1.8V using jumper JP3. Apply 12V to the input and 60A to the output. The voltage should be 1.8V ± 3%.
8. For operation at 100% load and room temperature ambient, use 100 LFM airflow or greater.

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9. Adjust the input voltage and load current to the desired levels within their limits and observe the regulation, output ripple, load step response, efficiency and other parameters.

NOTE: The BNC connectors labeled “VOUT+” and “LOAD STEP” can be used to monitor the output voltage and load step waveforms, respectively, on an oscilloscope.

DYNAMIC LOAD TESTING

DC438 is populated with a high di/dt dynamic load circuit that is capable of applying a 0A to 60A load step to the output. The lower level of the step is fixed at 0A. To test this circuit, follow the instructions below:

1) Put both the “DLC” jumper and the “DLC BIAS” jumper in the “ON” position.

- 2) Turn-on the converter and set the external load to the low level of the load step.
- 3) Adjust potentiometers R38, R34 and R33 to set the height, up slope and down slope of the load step respectively.
- 4) Monitor the load step current and output voltage. For the load step current, $5\text{mV} = 1\text{A}$.

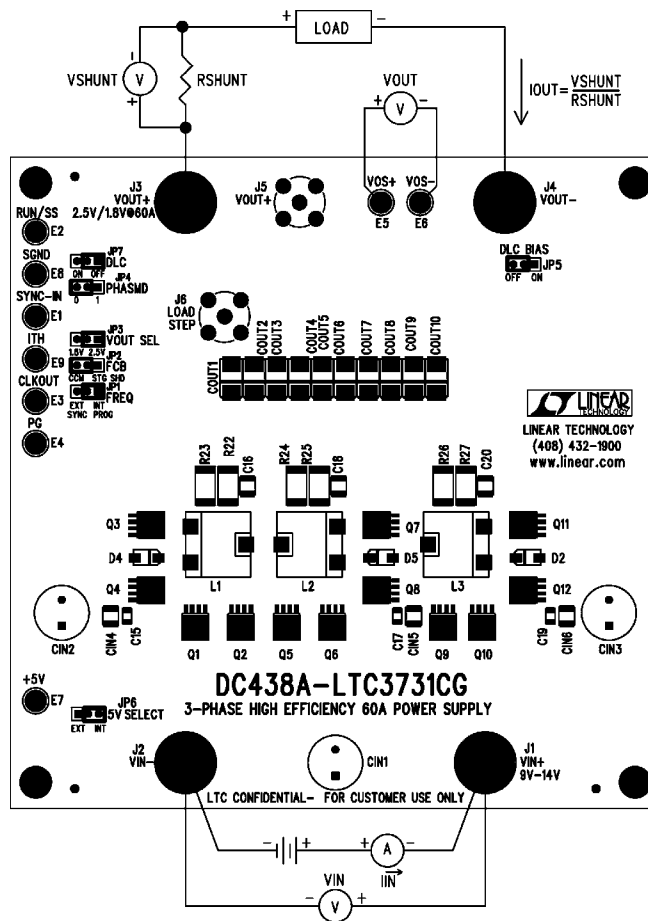
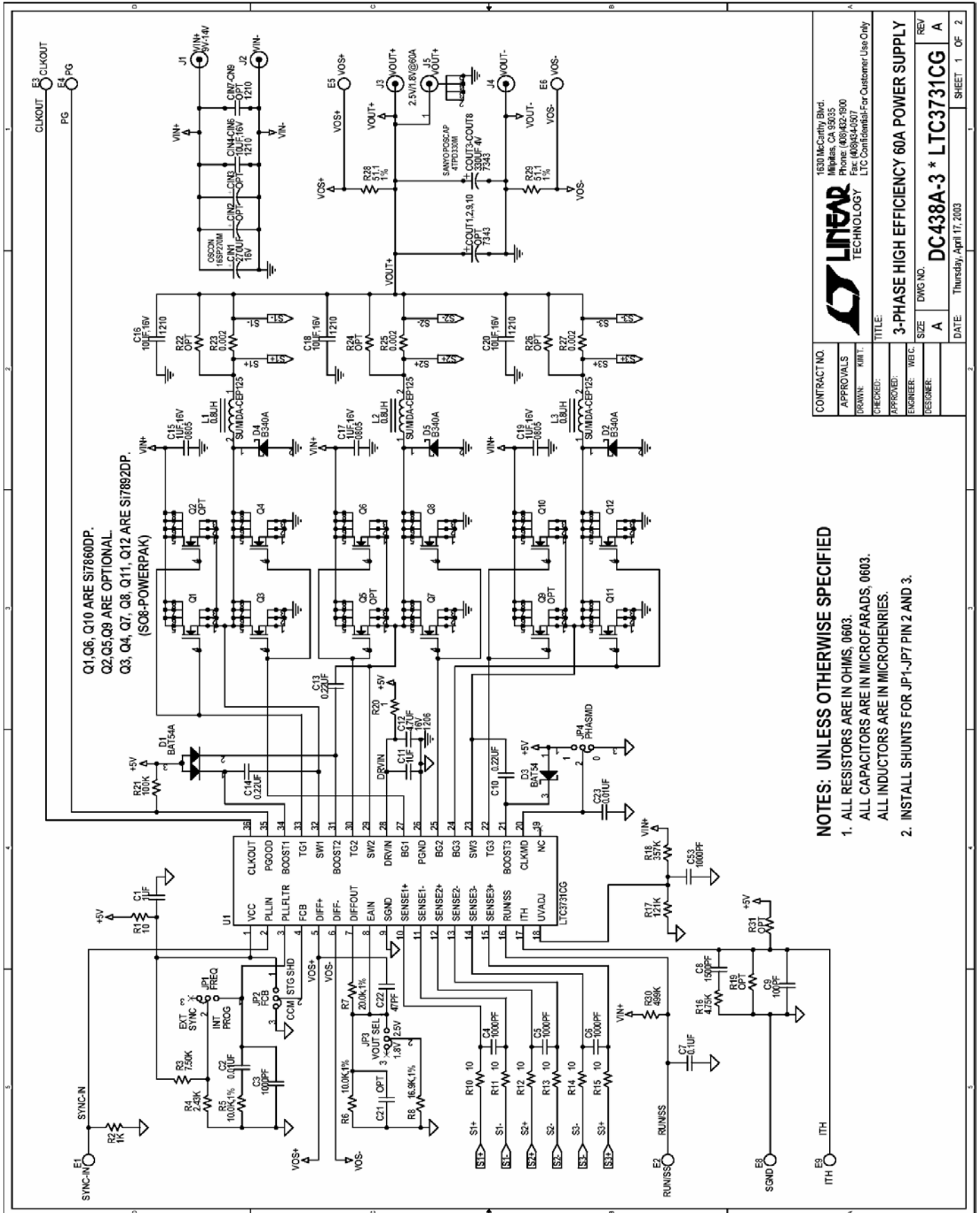


Figure 1. Proper Measurement Equipment Setup

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TRIPLE PHASE, SINGLE OUTPUT STEP-DOWN CONVERTER



NOTES: UNLESS OTHERWISE SPECIFIED

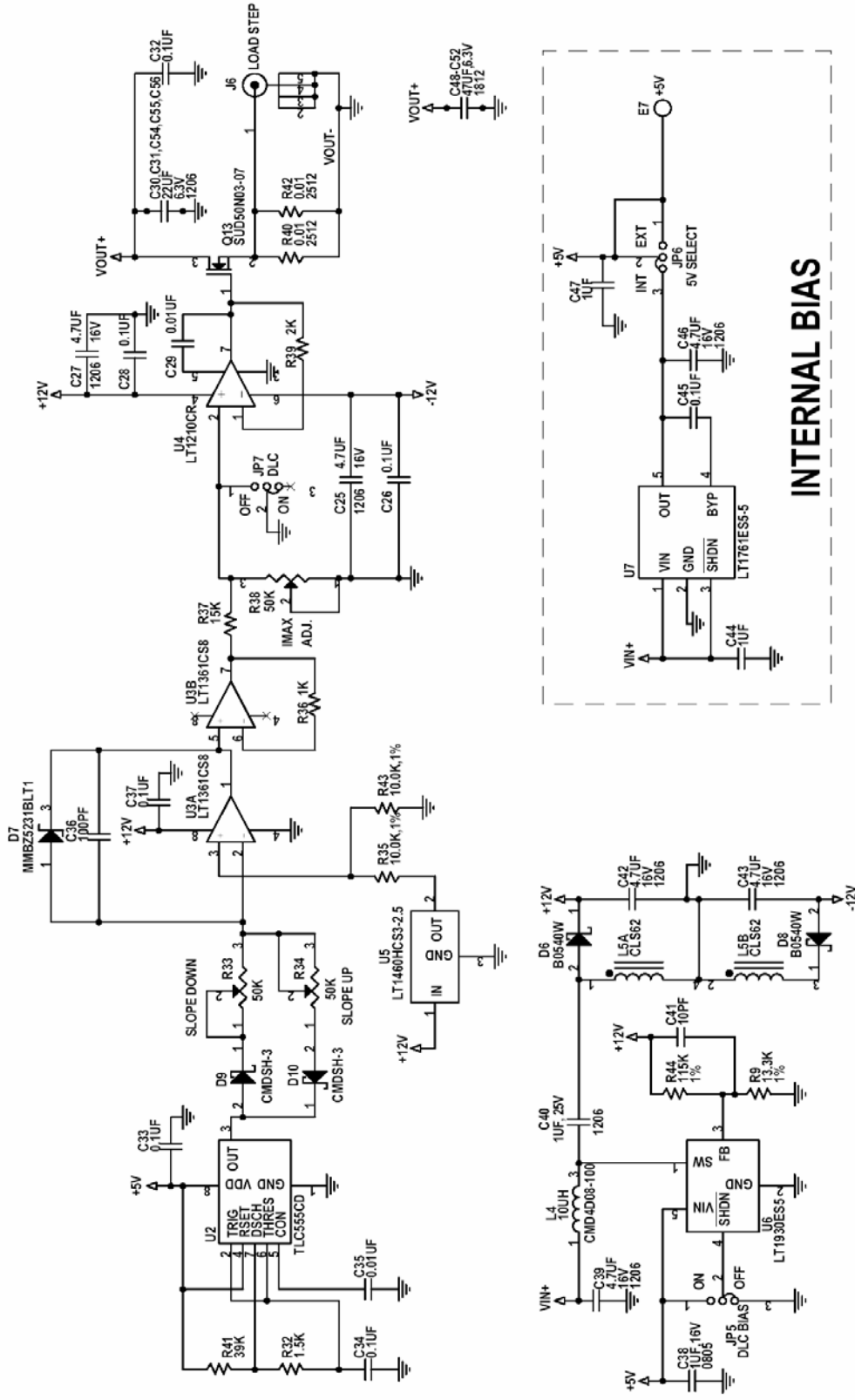
1. ALL RESISTORS ARE IN OHMS, 0603.
2. ALL CAPACITORS ARE IN MICROFARADS, 0603.
3. ALL INDUCTORS ARE IN MICROHENRIES.
4. INSTALL SHUNTS FOR JP1-JP7 PIN 2 AND 3.

CONTRACT NO.	1630 McCarthy Blvd. Milpitas, CA 95035 Phone: (408)432-1900 Fax: (408)434-9507 LTC Confidential-For Customer Use Only
APPROVALS	LINEAR TECHNOLOGY
DRAWN: K.M.T.	TITLE: 3-PHASE HIGH EFFICIENCY 60A POWER SUPPLY
CHECKED:	SIZE: A
APPROVED:	DWG. NO. DC438A-3 * LTC3731CG
ENGINEER: T.M.C.	DATE: Thursday, April 17, 2003
DESIGNER:	REV: A
	SHEET 1 OF 2

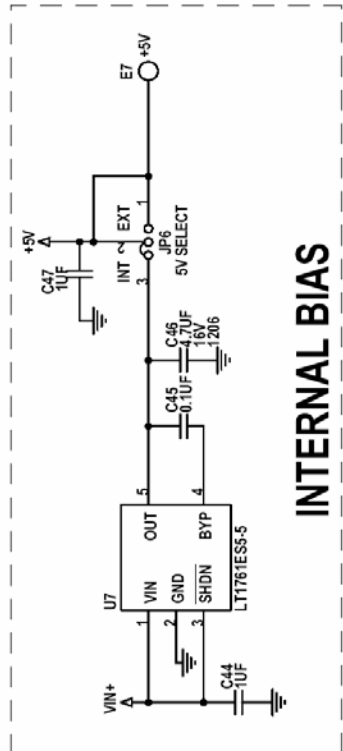
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TRIPLE PHASE, SINGLE OUTPUT STEP-DOWN CONVERTER

DYNAMIC LOAD CIRCUIT



INTERNAL BIAS



CONTRACT NO.		1630 McCarthy Blvd. Milpitas, CA 95035 Phone: (408)432-1900 Fax: (408)434-0507 LTC Confidential-For Customer Use Only	
APPROVALS			
DRAWN: RMT		TITLE: 3-PHASE HIGH EFFICIENCY 60A POWER SUPPLY	
CHECKED:		SIZE: A	
APPROVED:		DWG NO. DC438A-3 * LTC3731CG	
ENGINEER: WETC		REV: A	
DESIGNER:		DATE: Thursday, April 17, 2003	
		SHEET 2 OF 2	

<u>Item</u>	<u>Qty</u>	<u>Reference</u>	<u>Part Description</u>	<u>Manufacture / Part #</u>
1	1	CIN1	CAP., TRH HOLE 270uF 16V,C200D420	OSCON, 16SP270M
2	0	CIN2,CIN3	CAP., TRH HOLE 270uF 16V,C200D420	OSCON, 16SP270M
3	6	CIN4,CIN5,CIN6,C16,C18,C20	CAP., X5R 10UF 16V, 20%, 1210	TAIYO YUDEN, EMK325BJ106MNT
4	0	CIN7,CIN8,CIN9	CAP., 1210	TBD
5	0	COUT1,COUT2,COUT9,COUT10	CAP., 7343	OPT
6	6	COUT3-COUT8	CAP., 330UF 4V,7343	SANYO, 4TPD330M
7	4	C1,C11,C44,C47	CAP., X5R 1UF 10V,0603	TAIYO YUDEN, JMK107BJ105MA
8	4	C2,C23,C29,C35	CAP., X7R 0.01UF 16V 10%	AVX, 0603YC103KAT1A
9	5	C3,C4,C5,C6,C53	CAP., X7R 1000PF 50V 10%	AVX, 06035C102KAT1A
10	8	C7,C26,C28,C32-C34,C37,C45	CAP., X7R 0.1UF 16V 10%	AVX, 0603YC104KAT1A
11	1	C8	CAP., X7R 1500PF 50V 10%	AVX, 06035C152KAT1A
12	2	C9,C36	CAP., NPO 100PF 50V 10%	AVX, 06035A101KAT1A
13	3	C10,C13,C14	CAP., X7R 0.22UF 10V 10%	AVX, 0603ZC224KAT1A
14	7	C12,C25,C27,C39,C42,C43,C46	CAP., X7R 4.7UF 16V, 20%, 1206	TAIYO YUDEN, EMK316BJ475MLT
15	4	C15,C17,C19,C38	CAP., X7R 1UF 16V,0805	TAIYO YUDEN, EMK212BJ105MG
16	0	C21	CAP., 0603	TBD
17	1	C22	CAP., NPO 47PF 50V 10%	AVX, 06035A470KAT1A
18	5	C30,C31,C54,C55,C56	CAP., X7R 22UF 6.3V, 20%, 1206	TAIYO YUDEN, JMK316BJ226MLT
19	1	C40	CAP., X7R 1UF 25V 80%	AVX, 12063C105ZAT1A
20	1	C41	CAP., NPO 10PF 50V 10%	AVX, 06035A100KAT1A
21	5	C48-C52	CAP., X5R 47UF 6.3V, 20%, 1812	TAIYO YUDEN, JMK432BJ476MM
22	1	D1	DIODE,Schottky, SOT23	DIODES, BAT54A
23	3	D2,D4,D5	DIODE, SCHOTTKY 40V 3A, SMA-DIODE	DIODES INC., B340A-13
24	1	D3	DIODE,Schottky, SOT23	DIODES, BAT54
25	2	D6,D8	DIODE, SCHOTTKY RECTIFIER 0.5A,SOD123	DIODES INC., B0540W
26	1	D7	DIODE, MMBZ5231BLT1, SOT23	ON SEMI., MMBZ5231BLT1
27	2	D9,D10	DIODE, CMDSH-3, SOD323	CENTRAL, CMDSH-3
28	9	E1-E9	TESTPOINT, TURRET, .094"	MILL-MAX, 2501-2
29	7	JP1-JP7	JMP, 1X3 PINS, .079"	COMM, 2802S-03G2
30	7	SHUNTS FOR JP1-JP7	SHUNT, 2 PINS, .079"	COMM CON., CCIJ2mm-138G
31	4	J1,J2,J3,J4	STUD, TEST PIN	PEM KFH-032-10
32	8	FOR J1-J4	NUT, BRASS NUTS # 10-32	ANY #10-32
33	4	FOR J1-J4	RING, LUG RING # 10	KEYSTONE #10
34	4	FOR J1-J4	WASHER, TIN PLATED BRASS	ANY #10
35	2	J5,J6	CONN, BNC, 5 PINS	CONNEX, 112404

<u>Item</u>	<u>Qty</u>	<u>Reference</u>	<u>Part Description</u>	<u>Manufacture / Part #</u>
36	3	L1,L2,L3	IND, 0.8uH,L-CEP125	SUMIDA, CEP125-0R8NC-U
37	1	L4	IND POWER, 10UH, L-CMD4D08	SUMIDA, CMD4D08-100
38	1	L5	IND, 10UH, L-CLS62	SUMIDA, CLS62-100 (6328-TO64)
39	3	Q1,Q6,Q10	TRANS, N-CHANNEL, SO8-POWERPAK	SILICONIX, Si7860DP
40	0	Q2,Q5,Q9	TRANS, OPT, SO8-POWERPAK	OPT
41	6	Q3,Q4,Q7,Q8,Q11,Q12	TRANS, N-CHANNEL, SO8-POWERPAK	SILICONIX, Si7892DP
42	1	Q13	TRANS, SUD50N03-07,DPAK-TO252AA	SILICONIX, SUD50N03-07
43	7	R1,R10-R15	RES., Chip 10 1/16W 5%	AAC CR16-100JM
44	2	R2,R36	RES., Chip 1K 1/16W 5%	AAC CR16-102JM
45	1	R3	RES., Chip 7.50K 1/16W 5%	AAC CR16-752JM
46	1	R4	RES., Chip 2.43K 1/16W 1%	AAC CR16-2431FM
47	4	R5,R6,R35,R43	RES., Chip 10.0K 1/16W 1%	AAC CR16-1002FM
48	1	R7	RES., Chip 20.0K 1/16W 1%	AAC CR16-2002FM
49	1	R8	RES., Chip 16.9K 1/16W 1%	AAC CR16-1692FM
50	1	R9	RES., Chip 13.3K 1/16W 1%	AAC CR16-1332FM
51	1	R16	RES., Chip 4.75K 1/16W 1%	AAC CR16-4751FM
52	1	R17	RES., Chip 121K 1/16W 1%	AAC CR16-1213FM
53	1	R18	RES., Chip 357K 1/16W 1%	AAC CR16-3573FM
54	0	R19,R31	RES., 0603	TBD
55	1	R20	RES., Chip 1 1/16W 5%	AAC CR16-1R0JM
56	1	R21	RES., Chip 100K 1/16W 1%	AAC CR16-1003FM
57	0	R22,R24,R26	RES., 2512	TBD
58	3	R23,R25,R27	RES., 0.002 1W 5%, 2512	PANASONIC ERJM1WTJ2M0U
59	2	R28,R29	RES., Chip 51.1 1/16W 1%	AAC CR16-51R1FM
60	1	R30	RES., Chip 499K 1/16W 1%	AAC CR16-4993FM
61	1	R32	RES., Chip 1.5K 1/16W 5%	AAC CR16-152JM
62	3	R33,R34,R38	POT, 50K, 1TURN, G3A	BI, 22AR50K
63	1	R37	RES., Chip 15K 1/16W 5%	AAC CR16-153JM
64	1	R39	RES., Chip 2K 1/16W 5%	AAC CR16-202JM
65	2	R40,R42	RES., LRF 0.01 1W 5%	IRC LRF2512-01-R010-J
66	1	R41	RES., Chip 39K 1/16W 5%	AAC CR16-393JM
67	1	R44	RES., Chip 115K 1/16W 1%	AAC CR16-1153FM
68	1	U1	I.C., LTC3731CG, SSOP36G	LINEAR TECH., LTC3731CG
69	1	U2	I.C., TLC555CD, SO8	TEXAS INST., TLC555CD
70	1	U3	I.C., LT1361CS8, SO8	LINEAR TECH., LT1361CS8
71	1	U4	I.C., LT1210CR, DDPAK-R-7P	LINEAR TECH., LT1210CR
72	1	U5	I.C., LT1460HCS3-2.5, SOT23	LINEAR TECH., LT1460HCS3-2.5
73	1	U6	I.C., LT1930ES5, SOT23-5	LINEAR TECH., LT1930ES5
74	1	U7	I.C., LT1761ES5-5, SOT23-5	LINEAR TECH., LT1761ES5-5
75	4	FOR MTGS AT 4 CORNERS	SCREW, #4-40, 1/4"	ANY
76	4	FOR MTGS AT 4 CORNERS	STANDOFF, NYLON HEX #4-40 1/2"	MICROPLASTICS, 14HTSP003
		NOTES: UNLESS OTHERWISE SPECIFIED		
		1. ALL RESISTORS ARE IN OHMS, 0603.		
		2. INSTALL SHUNTS ON JP1-JP7 PIN 2 AND 3.		