LT8550
4-Phase DC/DC Expander with Internal Gate Drivers for Buck Converters

DESCRIPTION

Demonstration circuit 2331A-A/2331A-B is a 4-phase DC/DC expander with internal gate drivers for buck converters that features the LT®8550. The demonstration circuit expands (increases) the number of power sections for a LT3763 60V step-down controller to provide higher output power. The increased number of power sections allowed by the LT8550 results in more available output power without a corresponding increase in the difficulty of the design or a sacrifice of LT3763 features. The demo board uses the multi-chip (master-slave) feature of the LT8550 so the total number of power sections can be increased in four power section increments:

- DC2331A-A has one power section for the LT3763 primary controller and an additional four power sections for its LT8550 which is configured as a master
- DC2331A-B does not have a primary controller, and its LT8550 is configured as a slave with four power sections

The DC2331A-A and DC2331A-B use the same PCB and the PCB is an example of how ground plane layers should be configured and traces routed for reliable performance.

The input voltage range of DC2331A-A/DC2331A-B is from 14V to 56V and the output is 12V. The maximum output current is 14A per power section, so the maximum output current of DC2331A-A is 70A and each slave DC2331A-B adds an additional 56A of output current capability. The switching frequency is 250kHz and at 24V input to $12V_{OUT}$ at full load, the efficiency of DC2331A-A is 97.5%.

The DC2331A-A/DC2331A-B is designed so it is easy to add power sections and increase output power. The master and slave assemblies are programmed using jumpers and adjustment of regulation loop compensation is usually not necessary as power sections are added. The control signal interface between master and slave assemblies is a common ribbon cable. The power cabling between master and slave assemblies is similarly simple.

The DC2331A-A/DC2331A-B's jumpers program the phase relationship between the power sections and turn phase shedding on and off. Jumper JP5 programs the LT8550 SYNC pin for master or slave operation and allows DC2331A-A to be synchronized to an external clock. The VCC and RSYNC JP5 settings—and the DC2331A assemblies in general—are forward compatible with the next generation of phase expander ICs.

A ribbon cable provided with DC2331A-B interfaces the control logic between a master DC2331A-A and a single or multiple slave DC2331A-B(s). Each DC2331A-A/DC2331A-B has two identical ribbon cable headers, so daisy-chain ribbon cables are not required, even for systems with multiple slave assemblies. The DC2331A-A/DC2331A-B uses high current #10 bolt-on terminals for the input supply and load connections; and a sufficient quantity of #10 ring lugs is provided to parallel master and slaves with minimal DC offset voltage between assemblies. VIN^-, VIN^+, VO^- and VO^+ terminals allow convenient monitoring of input and output voltages while minimizing the measured I • R PCB voltage drops caused by high currents.

The DC2331A-A/DC2331A-B has terminals for $\overline{SHDN}$ and SYNC inputs to the LT8550. There are also terminals that make it easy to monitor the control logic between master and slave DC2331s. Removal of jumper resistors can cleanly separate the electrical interface between the LT3763 primary controller and the remainder of DC2331A-A, making it possible to connect an alternate primary controller in place of the LT3763. Noise immune signal and ground via pairs are available to re-establish the connections between DC2331A-A and twisted wire pairs sensing the new primary controller.

A combination of capacitors is used at the DC2331A-A/DC2331A-B power input: 1210 ceramics, 2220 ceramics in a metal frame, hybrids and bulk electrolytic capacitors.

DESCRIPTION

The 2220 ceramics in a metal frame are robust and convenient but may be replaced with an equivalent amount of 1210 capacitance to minimize electrical noise. The hybrid and bulk electrolytic capacitors stabilize the input power. A combination of ceramic and aluminum polymer capacitors are used at the power output in accordance with design practice for the LT3763 primary controller.

DC2331A-A/DC2331A-B includes filters and filter options for inputs to the LT8550 in accordance with data sheet recommendations. $\overline{SHDN}$ voltage, switching frequency and LT8550 ILIM current limit levels can all be adjusted by resistors or resistor jumpers. DC2331A-A/DC2331A-B comes with a housekeeping circuit that provides an 11.5V input voltage to the LT8550. The housekeeping circuit reduces the power dissipation that would otherwise occur at high input voltages in regulator transistor Q21. DC2331A-A/DC2331A-B uses resistors to sense inductor current, but can be configured for DCR sensing of inductor current.

DC2331A-A/DC2331A-B retains the features of the LT3763 primary controller including:

- two inputs for analog control of the output current regulation level
- output current monitoring
- fault indication.

A resistor divider combined with the CTRL1 output current regulation level control makes the LT3763 current limit occur before the LT8550 current limit to ensure that the power sections share equally during output current overload conditions. A resistor-NTC voltage divider combined with the CTRL2 control reduces output current when the PCB temperature reaches approximately 100°C. A sense resistor for input current can be added and used for input current regulation and monitoring. DC2331A-A has placeholders for optional components that will allow a voltage applied to the CTLV terminal to make modest changes to the output voltage.

A high level of available output power without a corresponding high level of design complexity or loss of controller features makes the LT8550 attractive for high current DC bus and battery systems in commercial, industrial and automotive settings. DC2331A-A/DC2331A-B features the LT8550EUKG in a thermally enhanced 52-pin 7mm x 8mm QFN package. The LT8550 and LT3763 data sheets must be read in conjunction with this demo manual to properly use or modify DC2331A-A/DC2331A-B.

Design files for this circuit board are available.

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Minimum Input Voltage, V_{IN}				14	V
Maximum Input Voltage, V_{IN}		56			V
Output Voltage, V_{OUT}	R17=12.1k, R18=107k, R19=909	11.6		12.4	V
Maximum Output Current, I_{OUT}	DC2331A-A	70			A
Maximum Output Current, I_{OUT}	DC2331A-A + DC2331A-B	126			A
Output Current Limit, I_{OUT}	DC2331A-A, R50 = 100k, R82 = 150k, RSNS5 = 0.0025		80		A
Output Current Limit, I_{OUT}	DC2331A-A + DC2331A-B, R50 = 100k, R82 = 150k, RSNS5 = 0.0025		144		A
Efficiency	DC2331A-A, V_{IN} = 24V, I_{OUT} = 70A		97.50		%
Switching Frequency			250		kHz

QUICK START PROCEDURE

To evaluate the performance of

- DC2331A-A without using the multi-chip (master-slave) feature of the LT8550, follow steps 1–8 of the procedure below
- DC2331A-A and DC2331A-B using the multi-chip (master-slave) feature of the LT8550, follow steps 9–17 of the procedure below.

Follow Steps 1–8 to Use DC2331A-A Without the Multi-Chip (Master-Slave) Feature:

1. Use a single DC2331A-A assembly
2. Prepare to use the $\overline{\text{SHDN}}$ terminal to control the startup: Connect the $\overline{\text{SHDN}}$ terminal to GND using a clip-on lead.
3. Set the MODE jumper JP4 to FLOAT if phase shedding is desired or to GND if phase shedding is not desired.
4. Set the SYNC jumper JP5 to GND.

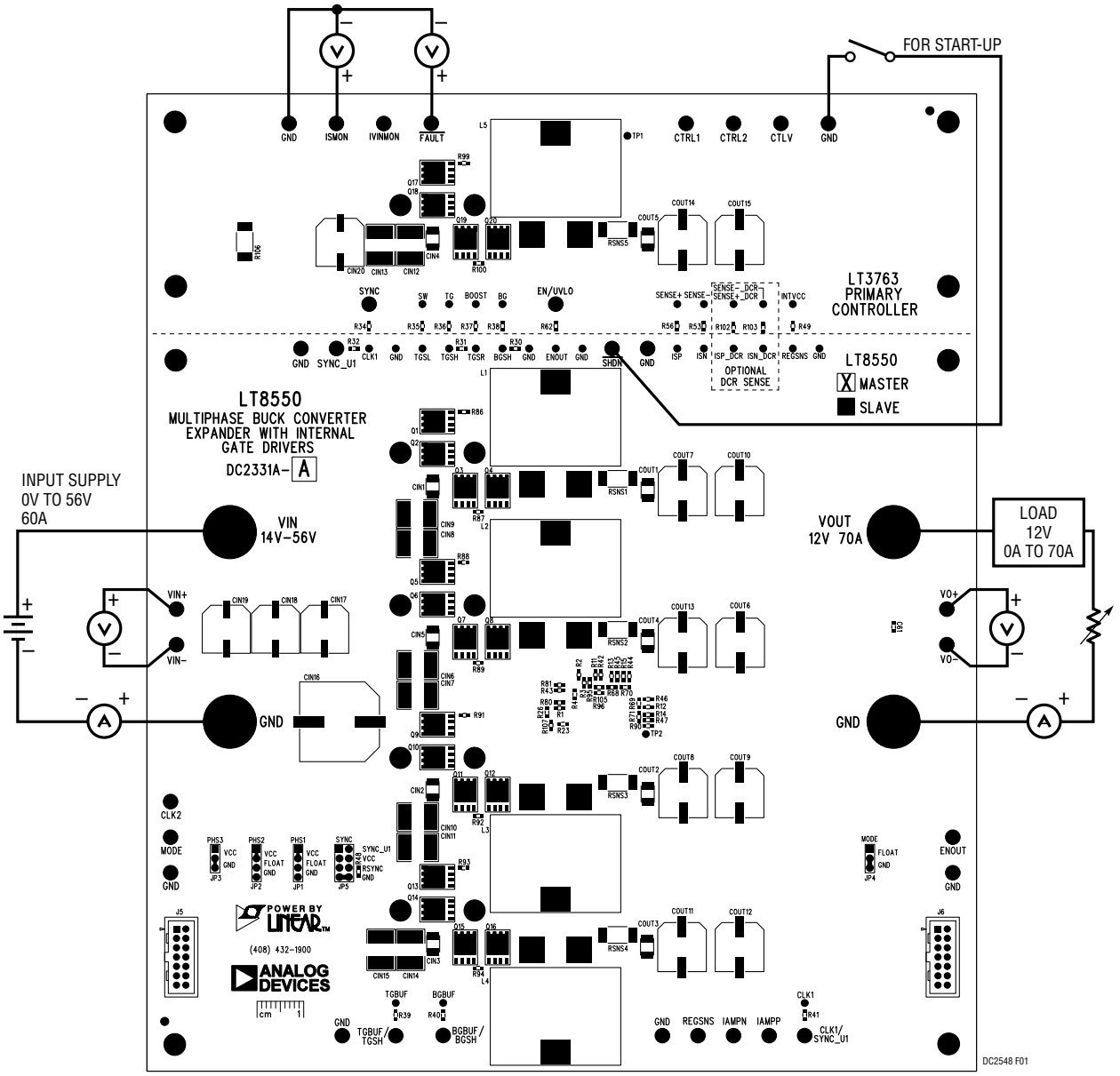


Figure 1. Proper Equipment Setup for DC2331A-A

QUICK START PROCEDURE

5. Set the phase selection jumpers as shown below:

JP3	GND
JP2	VCC
JP1	VCC

6. Connect the input power supply with power off, load and meters as shown in Figure 1, Proper Equipment Setup for DC2331A-A. See the next section, Power Connections Between Assemblies and Optional Heatsinks, for tips on how to connect input and output power.
7. After all connections are made, turn on the input power and verify that the input voltage is between 14V and 56V.
8. Remove the clip-on lead that connects the $\overline{\text{SHDN}}$ terminal to GND. Verify that the output voltage is 12V.

   See the note after step 17 below.

Follow Steps 9–17 to Use DC2331A-A and DC2331A-B with the Multi-Chip (Master-Slave) Feature:

9. Use a single DC2331A-A assembly and one or more DC2331A-B assemblies:
   - DC2331A-A has one power section for the LT3763 primary controller and an additional four power sections for its LT8550 which is configured as a master.
   - DC2331A-B does not have a primary controller, and its LT8550 is configured as a slave with four power sections.

   NOTE: It is easiest to do steps 10–13 before the $\overline{\text{SHDN}}$ terminals, ribbon cable and power wiring are connected:
10. Set the MODE jumpers JP4:
    - On the master assembly DC2331A-A, set JP4 to FLOAT if phase shedding is desired or to GND if phase shedding is not desired.
    - On the slave assemblies DC2331A-B, set JP4 to FLOAT.
11. Set the SYNC jumpers JP5:
    - On the master assembly DC2331A-A, set JP5 to GND.
    - On the slave assemblies DC2331A-B, set JP5 to SYNC_U1.
12. Set the phase selection jumpers for the master DC2331A-A as shown below, depending on the number of slave DC2331A-Bs:

DC2331A-A + DC2331A-B (One Slave)		**DC2331A-A + DC2331A-B and DC2331A-B (Two Slaves)**		
DC2331A-A		**DC2331A-A**		
JP3	GND	**JP3**	VCC	
JP2	FLOAT	**JP2**	VCC	
JP1	FLOAT	**JP1**	GND	

13. Set the phase selection jumpers for the slave DC2331A-B(s) as shown below, depending on the number of slave DC2331A-Bs:

DC2331A-A + DC2331A-B (One Slave)		**DC2331A-A + DC2331A-B and DC2331A-B (Two Slaves)**			
DC2331A-B		**First DC2331A-B**		**Second DC2331A-B**	
JP3	GND	**JP3**	GND	**JP3**	GND
JP2	VCC	**JP2**	VCC	**JP2**	FLOAT
JP1	VCC	**JP1**	VCC	**JP1**	FLOAT

14. Prepare to use the $\overline{\text{SHDN}}$ terminal to control the startup:
    - Connect all the $\overline{\text{SHDN}}$ terminals together using clip-on leads and then GND any of the $\overline{\text{SHDN}}$ terminals with an additional clip-on lead.
15. In accordance with Figure 2, Proper Equipment Setup for DC2331A-A and DC2331A-B:
    - Connect the ribbon cable provided with DC2331A-B to interface the control logic between the master DC2331A-A and a single or multiple slave DC2331A-B(s). Each DC2331A-A/-B has two identical ribbon cable headers, so daisy-chain ribbon cables are not required, even for systems with multiple slave assemblies.

QUICK START PROCEDURE

- Connect the input power supply with power off, load and meters. See the next section, Power Connections Between Assemblies and Optional Heatsinks, for tips on how to connect input and output power.

16. After all connections are made, turn on the input power and verify that the input voltage is between 14V and 56V.
17. Remove the clip-on lead that connects all the $\overline{\text{SHDN}}$ terminals to GND. Verify that the output voltage is 12V.

NOTE: If the output voltage is low, try startup again using $\overline{SHDN}$ with the load disconnected. The load may cause low output if some of the DC2331A power sections are inadvertently disconnected and not able to deliver power. It is possible the input supply may current limit and cause DC2331A to have low output. In more extreme cases it is possible that the load may be set too high for DC2331A.

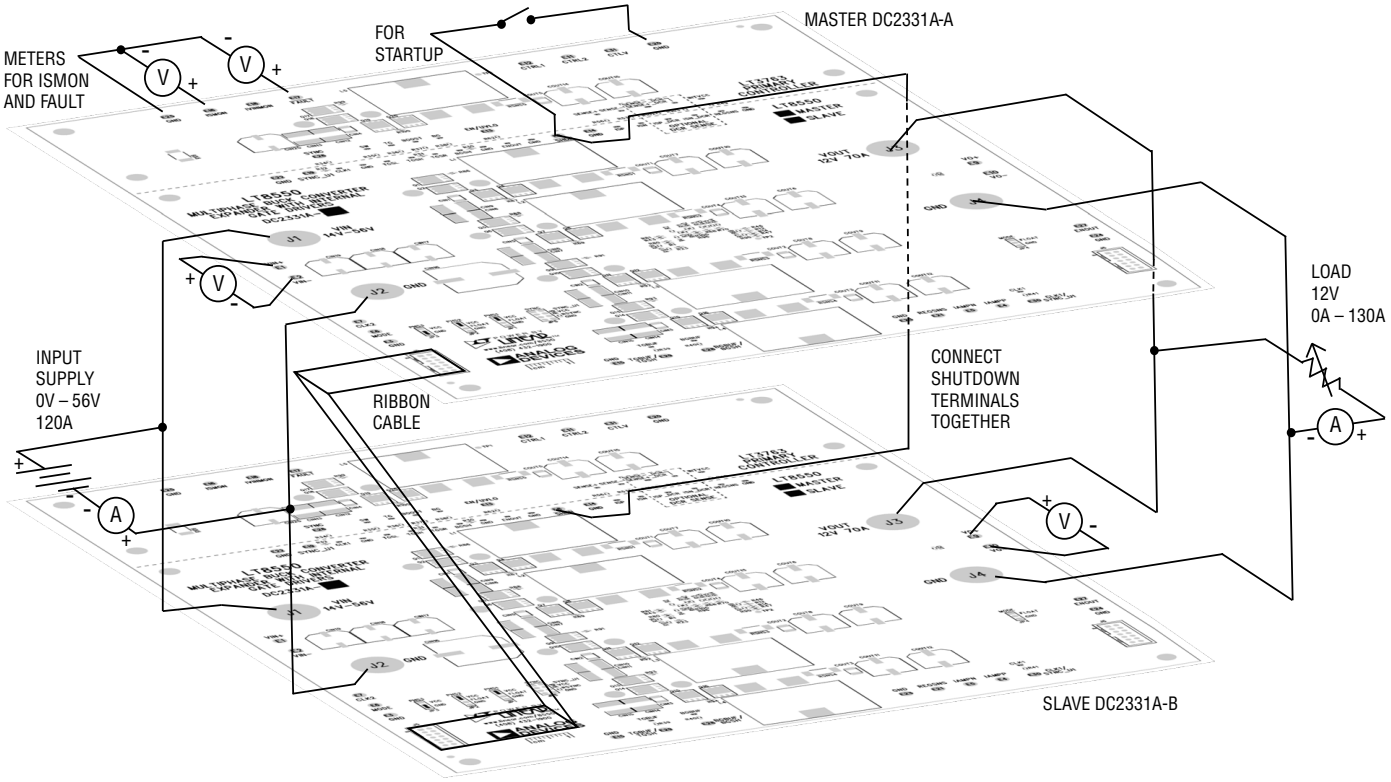


Figure 2. Proper Equipment Setup for DC2331A-A and DC2331A-B

QUICK START PROCEDURE

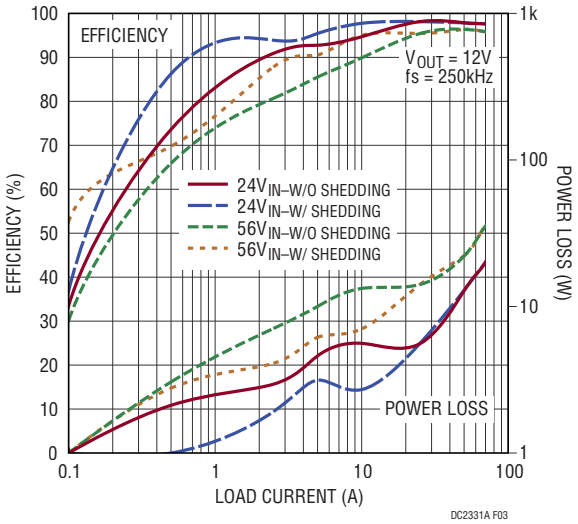


Figure 3. Efficiency and Power Loss—DC2331A-A

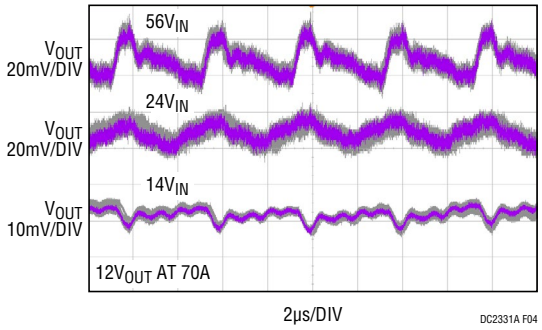


Figure 4. 12V_{OUT} at 70A V_{OUT} Ripple with Infinite Persist—DC2331A-A

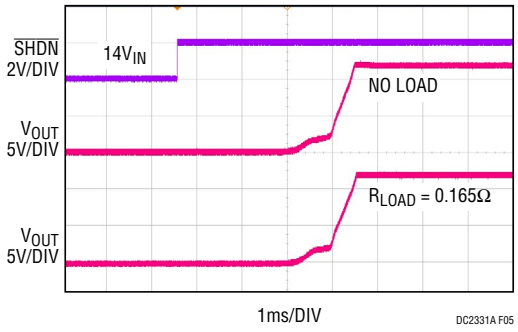


Figure 5. 14V_{IN} Start-Up at No Load and Full Load—DC2331A-A

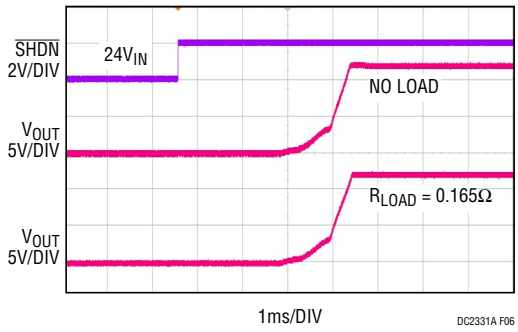


Figure 6. 24V_{IN} Start-Up at No Load and Full Load—DC2331A-A

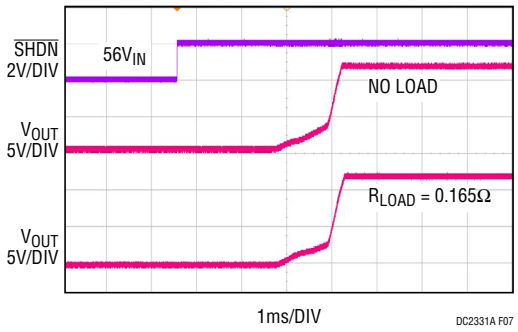


Figure 7. 56V_{IN} Start-Up at No Load and Full Load—DC2331A-A

QUICK START PROCEDURE

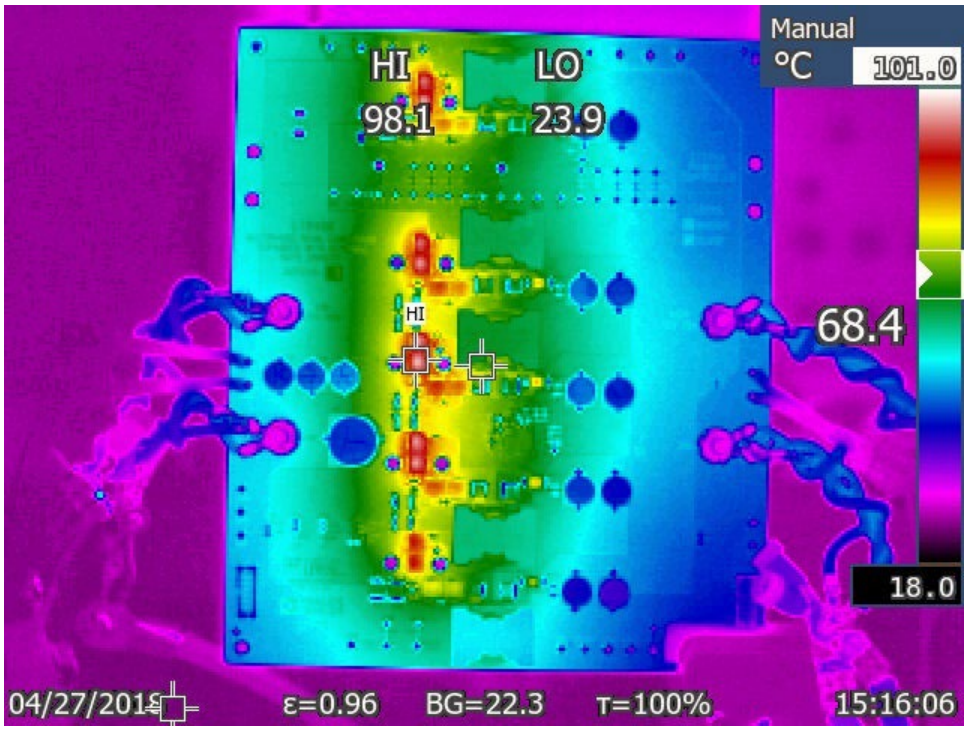


Figure 8. 56V_{IN}, 12V_{OUT} at 70A Thermal Image—DC2331A-A. Vertical Orientation with No Forced Air

POWER CONNECTIONS BETWEEN ASSEMBLIES AND OPTIONAL HEATSINKS

The power connections between master and slave DC2331A assemblies—and between the DC2331A system and the input supply or load—can be assembled using the common components and hand tools shown in Figure 9.

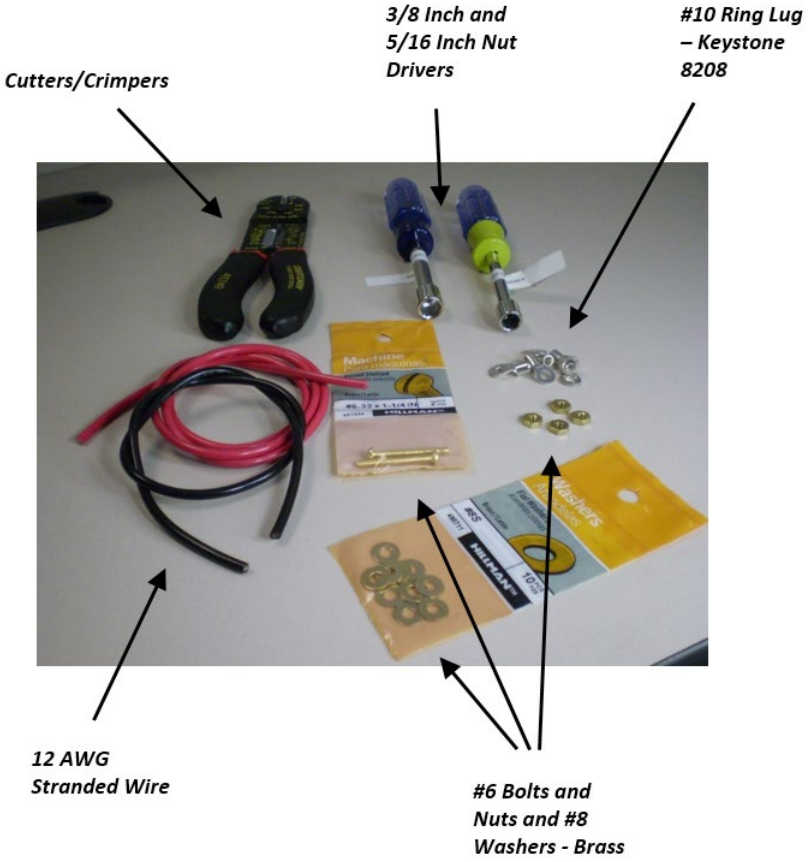


Figure 9. Power Cabling is Assembled Using Common Components and Hand Tools

POWER CONNECTIONS BETWEEN ASSEMBLIES AND OPTIONAL HEATSINKS

The power connections between master and slave DC2331A assemblies are important since unequal I*R voltage drops in the power ground connections (VIN ground in parallel with VOUT ground) between the assemblies can cause an offset voltage between the master and slave assembly grounds. Consequently, the offset voltage between master and slave grounds will cause undesired current in the signal grounds of the control interface ribbon cable. The potential sources of the offset voltages between DC2331A master and slave grounds, VDROP1 and VDROP2, are labeled in Figure 10.

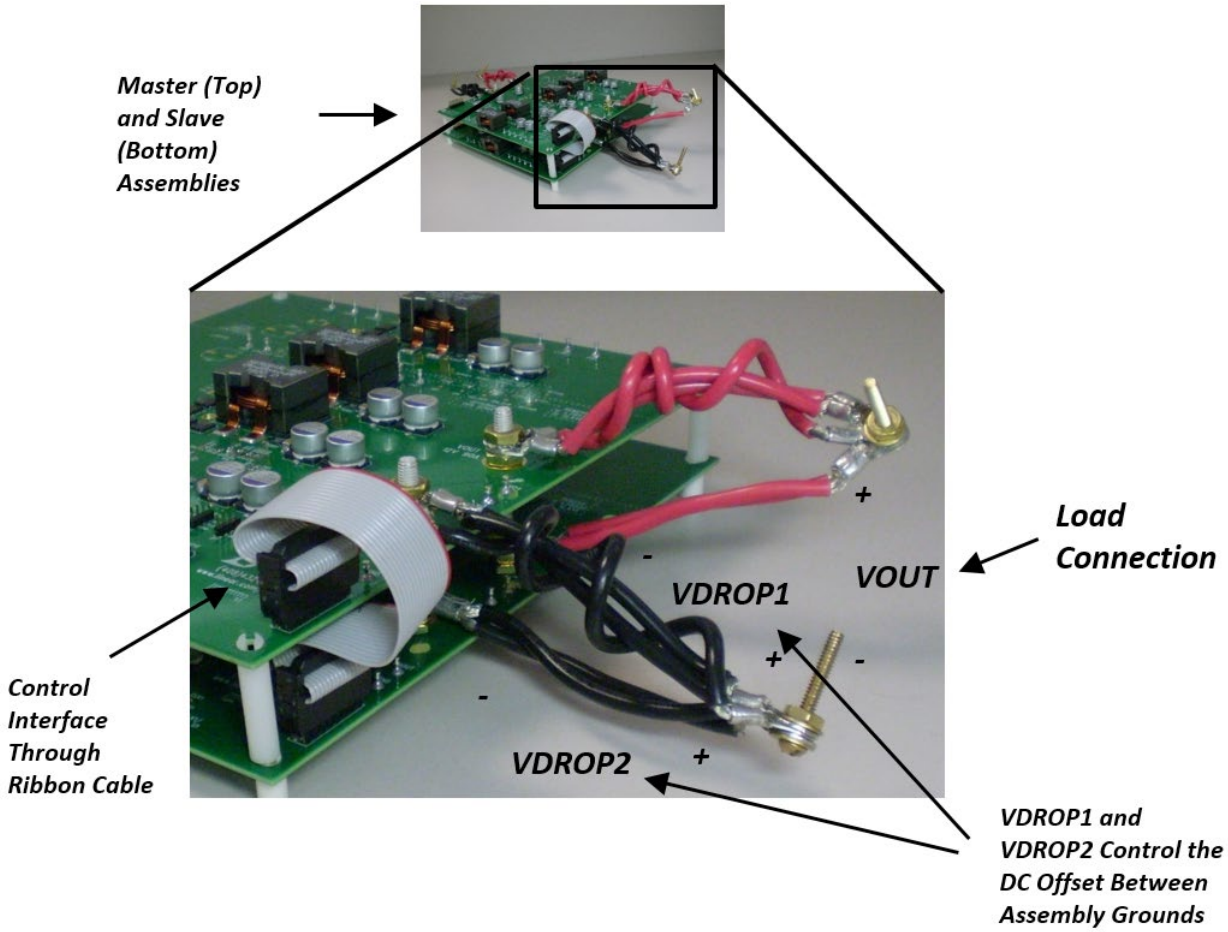


Figure 10. Offset Voltages V_{DROP1} and V_{DROP2} Between DC2331A Master and Slave Grounds. Make V_{DROP1} = V_{DROP2} to Prevent Undesired Current In the Signal Grounds of the Control Interface Ribbon Cable

POWER CONNECTIONS BETWEEN ASSEMBLIES AND OPTIONAL HEATSINKS

To minimize the offset voltage between assembly grounds, the resistance of the ground power cabling should be inversely proportional to the number of power sections that connect through the ground cabling. In other words, if the master assembly has five power sections and the slave assembly has four power sections, then the resistance of the master ground cabling should be 4/5 of the slave ground cable resistance. Figure 11 shows how to make a ground cable that is 4/5 the resistance of a reference ground cable.

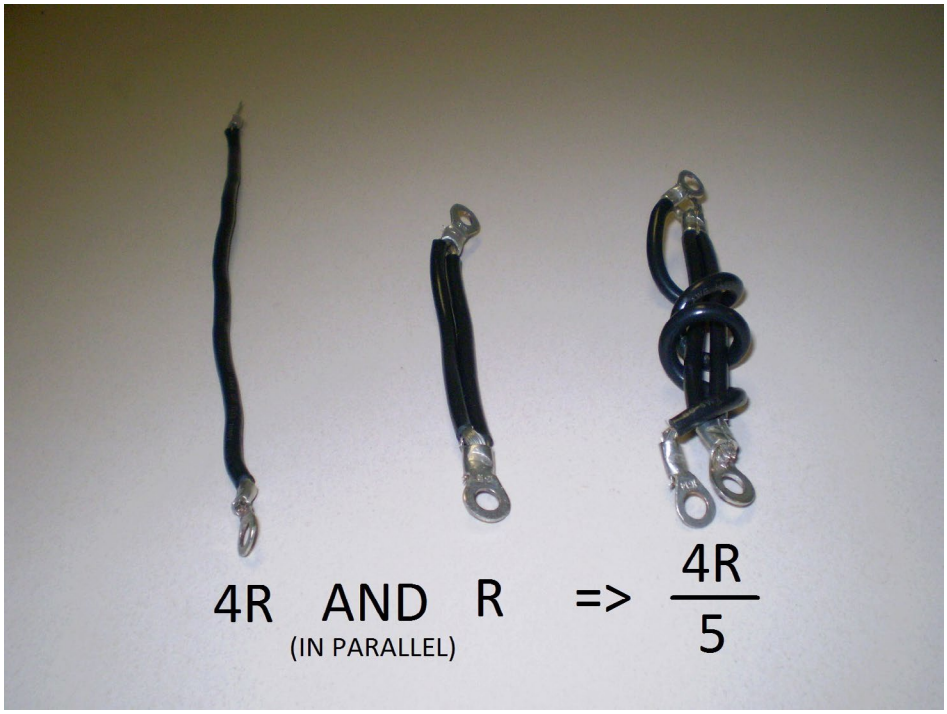


Figure 11. The 4/5 R Ground Cable Is Made from a 4R and an R Ground Cable and Can Be Used to Minimize the Offset Voltage Between Assembly Grounds

POWER CONNECTIONS BETWEEN ASSEMBLIES AND OPTIONAL HEATSINKS

Heatsinks as shown in Figure 12 can be added to each master and slave DC2331A assembly power section. When used with a fan, the heatsinks will decrease the thermal resistance between the DC2331A power components and the ambient environment to increase output power capability or lower component temperatures. The DC2331A PCB design provides holes for heatsink mounting.

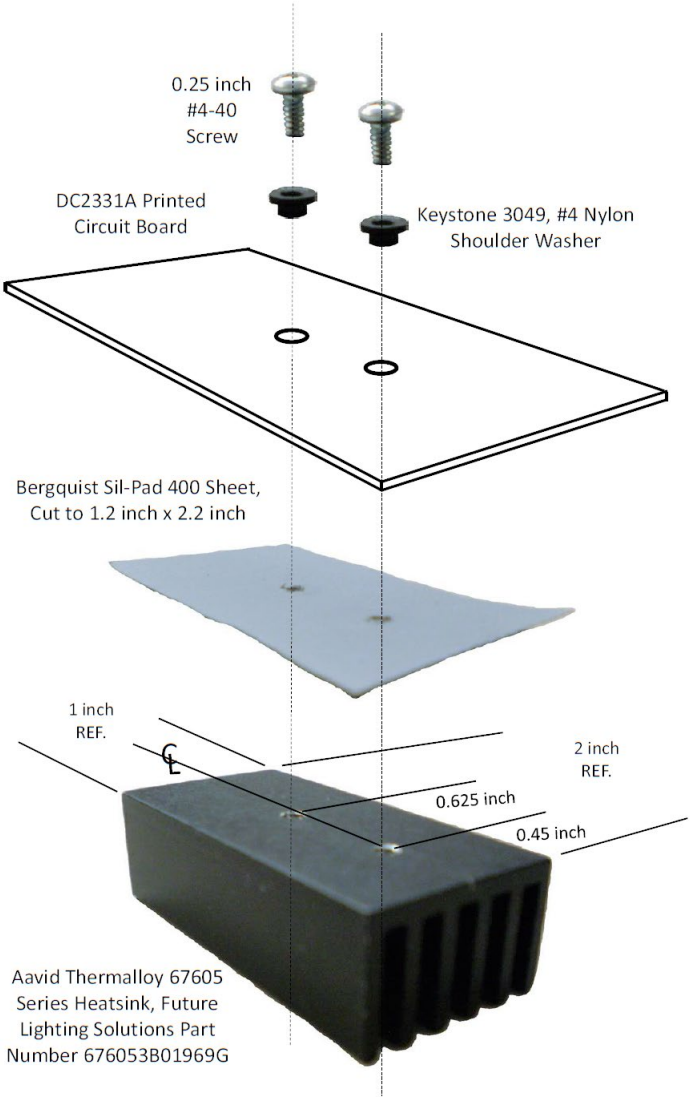


Figure 12. Heatsinks Can Be Added to DC2331A Assemblies for Improved Thermal Performance

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
DC2331A-A Required Circuit Components				
1	5	CIN1, CIN2, CIN3, CIN4, CIN5	CAP., X7S, 4.7µF, 100V, 10%, 1210	MURATA, GRJ32DC72A475KE11L
2	10	CIN6, CIN7, CIN8, CIN9, CIN10, CIN11, CIN12, CIN13 CIN14, CIN15	CAP., X7R, 15µF, 100V, 10%, 2220 (J-LEAD)	MURATA, KRM55WR72A156MH01K
3	3	CIN17, CIN18, CIN19	CAP., ALUM., POLYMER, 47µF, 63V, 20%	SUN ELEC., 63HVH47M
4	5	COUT1, COUT2, COUT3, COUT4, COUT5	CAP., X7R, 22µF, 16V, 20%, 1210	MURATA, GRM32ER71C226MEA8L
5	10	COUT6, COUT7, COUT8, COUT9, COUT10, COUT11, COUT12, COUT13, COUT14, COUT15	CAP., ALUM., 150µF, 16V, 20%	PANASONIC, 16SVP150M
6	1	C1	CAP., X7R, 2.2µF, 100V, 20%, 1206	MURATA, GRM31CR72A225MA73L
7	3	C2, C25, C33	CAP., X5R, 2.2µF, 16V, 10%, 0603	MURATA, GRM188R61C225KE15D
8	1	C3	CAP., X5R, 10µF, 16V, 10%, 0603	MURATA, GRM188R61C106KAALD
9	10	C4, C5, C8, C9, C10, C11,	CAP., X7R, 1000pF, 25V, 10%, 0603	MURATA, GRM188R71E102KA01D
		C12, C13, C15, C35		
10	1	C6	CAP., X7R, 100pF, 16V, 10%, 0603	AVX, 0603YC101KAT2A
11	4	C14, C27, C36, C57	CAP., X7R, 0.01µF, 16V, 10%, 0603	MURATA, GRM188R71C103KA01D
12	5	C17, C18, C19, C20, C21	CAP., X7R, 0.22µF, 16V, 10%, 0603	MURATA, GRM188R71C224KA01D
13	1	C22	CAP., NP0, 47pF, 50V, 5%, 0603	MURATA, GRM1885C1H470JA01D
14	1	C23	CAP., X7R, 1µF, 100V, 10%, 1206	MURATA, GRM31CR72A105KA01L
15	1	C24	CAP., X7R, 1µF, 16V, 10%, 0603	MURATA, GRM188R71C105KA12D
16	1	C26	CAP., NP0, 10pF, 50V, 5%, 0603	MURATA, GRM1885C1H100JA01D
17	1	C28	CAP., X7R, 2.2µF, 100V, 10%, 1210	MURATA, GRM32ER72A225KA35L
18	1	C29	CAP., X5R, 22µF, 16V, 20%, 0805	MURATA, GRM21BR61C226ME44L
19	1	C30	CAP., X7R, 0.033µF, 16V, 10%, 0603	MURATA, GRM188R71C333KA01D
20	1	C31	CAP., X7R, 4700pF, 16V, 10%, 0603	MURATA, GRM188R71C472KA01D
21	1	C32	CAP., X5R, 47µF, 16V, 10%, 1210	MURATA, GRM32ER61C476KE15K
22	2	C34, C62	CAP., X7R, 0.1µF, 16V, 10%, 0603	MURATA, GRM188R71C104KA01D
23	1	C60	CAP., NP0, 22pF, 50V, 5%, 0603	MURATA, GRM1885C1H220JA01D
24	7	D1, D2, D3, D4, D5, D6, D7	DIODE, SCHOTTKY, 100V, SOD323	NXP, BAT46WJ,115
25	1	D8	DIODE, 80V, SOD523	DIODES INC.,1N4448HWT-7
26	5	L1, L2, L3, L4, L5	IND., 6.8µH	COILCRAFT, SER2915L-682KL
27	1	L6	IND., 47µH	Wurth Elektronik, 744771147
28	20	Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q11, Q12, Q13, Q14, Q15, Q16, Q17, Q18, Q19, Q20	XSTR., MOSFET, 60V, PG-TDSON-8	INFINEON, BSC100N06LS3
29	1	Q21	MOSFET, P-CH 100V 2.6A SOT223	DIODES INC., ZXMP10A18G
30	5	RSNS1, RSNS2, RSNS3, RSNS4, RSNS5	RES., SENSE, 0.0025Ω, 3W, 1%, 2512	NIC, NCSR300F2M50DTRGF IRC/TT Electronics, ULRG32512R0025FLFSLT Panasonic, ERJMP4PF2M5U

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
31	2	R1, R50	RES., 100k, 1/10W, 1%, 0603	VISHAY, CRCW0603100KFKEA
32	1	R2	RES., 118k, 1/10W, 1%, 0603	VISHAY, CRCW0603118KFKEA
33	1	R3	RES., 13k, 1/10W, 1%, 0603	VISHAY, CRCW060313K0FKEA
34	2	R4, R98	RES., 47k, 1/10W, 5%, 0603	VISHAY, CRCW060347K0JNEA
35	6	R7, R11, R12, R13, R14, R15	RES., CHIP, 10Ω, 1/10W, 5%, 0603	VISHAY, CRCW060310R0JNEA
36	1	R8	RES., CHIP, 20Ω, 1/10W, 5%, 0603	VISHAY, CRCW060320R0JNEA
37	1	R10	RES., CHIP, 1Ω, 1/10W, 5%, 0603	VISHAY, CRCW06031R00JNEA
38	1	R16	RES., 210k, 1/10W, 1%, 0603	VISHAY, CRCW0603210KFKEA
39	1	R17	RES., 12.1k, 1/10W, 1%, 0603	VISHAY, CRCW060312K1FKEA
40	1	R18	RES., 107k, 1/10W, 1%, 0603	VISHAY, CRCW0603107KFKEA
41	1	R19	RES., 909Ω, 1/10W, 1%, 0603	VISHAY, CRCW0603909RFKEA
42	1	R20	RES, 10k, 1/10W, 5%, 0603	VISHAY, CRCW060310K0JNEA
43	3	R21, R22, R25	RES., 10Ω, 1/10W, 5%, 0603	VISHAY, CRCW060310R0JNEA
44	1	R27	RES., 19.6k, 1/10W, 1%, 0603	VISHAY, CRCW060319K6FKEA
45	1	R28	RES., 75k, 1/10W, 1%, 0603	VISHAY, CRCW060375K0FKEA
46	1	R29	RES., 1M, 1/10W, 1%, 0603	VISHAY, CRCW06031M00FKEA
47	1	R82	RES., 150k, 1/10W, 1%, 0603	VISHAY, CRCW0603150KFKEA
48	1	U1	I.C., LT8550, 52QFN	ANALOG DEVICES, LT8550EUKG#PBF
49	1	U2	I.C., LED DRIVER, 28TSSOP	ANALOG DEVICES, LT3763EFE#PBF
50	1	U3	I.C., REG., TSSOP28FE-EA	ANALOG DEVICES, LT8631EFE#PBF
DC2331A-A Additional Demo Board Circuit Components				
1	1	CIN16	CAP., ALUM., 470µF, 20%, 63V	PANASONIC, EEV-FK1J471M
2	0	CIN20(OPT)	CAP., ALUM., OPTION	
3	1	C7	CAP., X7R, 1000pF, 25V, 10%, 0603	MURATA, GRM188R71E102KA01D
4	1	C16	CAP., ALUM., 10µF, 100V, 20%	SUN ELEC., 100CE10BS
5	0	C37, C38, C39, C40, C41, C42, C43, C44, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C58, C59(OPT)	CAP., OPTION, 0603	
6	1	C61	CAP., X7R, 0.1µF,16V, 10%, 0603	MURATA, GRM188R71C104KA01D
7	0	Q22(OPT)	TRAN., OPTION, SOT-23	
8	1	RT1	THERMISTOR, NTC, 470KΩ, 0603	MURATA, NCP18WM474J03RB
9	15	R5, R6, R23, R34, R35, R36, R37, R38, R39, R40, R41, R49, R53, R56, R62	RES., CHIP, 0Ω, 1/10W, 1%, 0603	VISHAY, CRCW06030000Z0EA
10	0	R9, R26, R30, R31, R32, R33, R42, R43, R44, R45, R46, R47, R57, R58, R59, R60, R63, R64, R65, R66, R67, R68, R69, R70, R71, R76, R77, R78, R79, R80, R81, R84, R85, R86, R87, R88, R89, R90, R91, R92, R93, R94, R95, R102, R103, R104, R105, R107, R108, R109, R110, R111, R112, R113, R114, R115, R116, R117, R118, R119(OPT)	RES., OPTION, 0603	

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
11	2	R24, R52	RES., 47k, 1/10W, 5%, 0603	VISHAY, CRCW060347K0JNEA
12	1	R51	RES., 100k, 1/10W, 1%, 0603	VISHAY, CRCW0603100KFKEA
13	1	R48	RES., 133k, 1/10W, 1%, 0603	VISHAY, CRCW0603133KFKEA
14	1	R54	RES., 10k, 1/10W, 5%, 0603	VISHAY, CRCW060310K0JNEA
15	1	R55	RES., 15k, 1/10W, 1%, 0603	VISHAY, CRCW060315K0FKEA
16	1	R61	RES., 1M, 1/10W, 1%, 0603	VISHAY, CRCW06031M00FKEA
17	0	R72, R73, R74, R75(OPT)	RES., OPTION, 0805	
18	0	R83(OPT)	RES., OPTION, 0805	
19	0	R106(OPT)	RES., OPTION, 2512	
20	0	U4 (OPT)	I.C., OPTION, OPAMP, 8MSOP	ANALOG DEVICES, LT1636CMS8#PBF
DC2331A-A Hardware: For Demo Board Only				
1	31	E1, E2, E3, E4, E5, E6, E7, E8, E9, E10, E11, E12, E13, E14, E15, E16, E17, E18, E19, E20 E21, E22, E23, E24, E25, E26, E27, E28 E29, E30, E31	TESTPOINT, TURRET, .061"	MILL-MAX, 2308-2-00-80-00-00-07-0
2	2	JP1, JP2	HEADER 4 PIN 0.079 SINGLE ROW	WURTH ELEKTRONIK, 62000411121
3	2	JP3, JP4	HEADER 3 PIN 0.079 SINGLE ROW	WURTH ELEKTRONIK, 62000311121
4	1	JP5	HEADER 2X4 PIN, 0.079	WURTH ELEKTRONIK, 62000821121
5	5	XJP1, XJP2, XJP3, XJP4, XJP5	SHUNT, 2mm	WURTH ELEKTRONIK, 60800213421
6	4	J1-J4	STUD, TEST PIN	PEM, KFH-032-10ET
7	8	(J1-J4)	NUT, BRASS NUTS # 10-32	ANY, 10-32M/S BR PL
8	12	(J1-J4)	RING, LUG RING # 10	KEYSTONE, 8208
9	4	(J1-J4)	WASHER, TIN PLATED BRASS	ANY, #10EXT- BZ TN
10	2	J5, J6	HEADER, 2X7PIN, 0.079"	MOLEX, 87831-1420
11	4	MH1-MH4	STAND-OFF, NYLON 1.0"	WURTH ELEKTRONIK, 702939000

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
DC2331A-B Required Circuit Components				
1	4	CIN1, CIN2, CIN3, CIN5	CAP., X7S, 4.7µF, 100V, 10%, 1210	MURATA, GRJ32DC72A475KE11L
2	8	CIN6, CIN7, CIN8, CIN9, CIN10, CIN11, CIN14, CIN15	CAP., X7R, 15µF, 100V, 10%, 2220 (J-LEAD)	MURATA, KRM55WR72A156MH01K
3	3	CIN17, CIN18, CIN19	CAP., ALUM., POLYMER, 47µF, 63V, 20%	SUN ELEC., 63HVH47M
4	4	COUT1, COUT2, COUT3, COUT4	CAP., X7R, 22µF, 16V, 20%, 1210	MURATA, GRM32ER71C226MEA8L
5	8	COUT6, COUT7, COUT8, COUT9, COUT10, COUT11, COUT12, COUT13	CAP., ALUM., 150µF, 16V, 20%	PANASONIC, 16SVP150M
6	1	C1	CAP., X7R, 2.2µF, 100V, 20%, 1206	MURATA, GRM31CR72A225MA73L
7	2	C2, C33	CAP., X5R, 2.2µF, 16V, 10%, 0603	MURATA, GRM188R61C225KE15D
8	1	C3	CAP., X5R, 10µF, 16V, 10%, 0603	MURATA, GRM188R61C106KAALD
9	7	C8, C9, C10, C11, C12, C13, C35	CAP., X7R, 1000pF, 25V, 10%, 0603	MURATA, GRM188R71E102KA01D
10	1	C6	CAP., X7R, 100pF, 16V, 10%, 0603	AVX, 0603YC101KAT2A
11	4	C17, C18, C19, C20	CAP., X7R, 0.22µF, 16V, 10%, 0603	MURATA, GRM188R71C224KA01D
12	1	C24	CAP., X7R, 1µF, 16V, 10%, 0603	MURATA, GRM188R71C105KA12D
13	1	C26	CAP., NP0, 10pF, 50V, 5%, 0603	MURATA, GRM1885C1H100JA01D
14	1	C27	CAP., X7R, 10nF, 16V, 10%, 0603	MURATA, GRM188R71C103KA01D
15	1	C28	CAP., X7R, 2.2µF, 100V, 10%, 1210	MURATA, GRM32ER72A225KA35L
16	1	C32	CAP., X5R, 47µF, 16V, 10%, 1210	MURATA, GRM32ER61C476KE15K
17	2	C34, C62	CAP., X7R, 0.1µF, 16V, 10%, 0603	MURATA, GRM188R71C104KA01D
18	1	C55	CAP., X7R, 220pF, 25V, 10%, 0603	AVX, 06033C221KAT4A
19	4	D1, D2, D3, D4	DIODE, SCHOTTKY, 100V, SOD323	NXP, BAT46WJ,115
20	4	L1, L2, L3, L4	IND., 6.8µH	COILCRAFT, SER2915L-682KL
21	1	L6	IND., 47µH	Wurth Elektronik, 744771147
22	16	Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q11, Q12, Q13, Q14, Q15, Q16	XSTR., MOSFET, 60V, PG-TDSON-8	INFINEON, BSC100N06LS3
23	1	Q21	MOSFET, P-CH 100V 2.6A SOT223	DIODES INC., ZXMP10A18G
24	4	RSNS1, RSNS2, RSNS3, RSNS4	RES., SENSE, 0.0025Ω, 3W, 1%, 2512	NIC, NCSR300F2M50DTRGF IRC/TT ELECTRONICS, ULRG32512R0025FLFSLT PANASONIC, ERJMP4PF2M5U
25	1	R2	RES., 118k, 1/10W, 1%, 0603	VISHAY, CRCW0603118KFKEA
26	1	R3	RES., 13k, 1/10W, 1%, 0603	VISHAY, CRCW060313K0FKEA
27	6	R7, R12, R13, R14, R15, R26	RES., CHIP, 10Ω, 1/10W, 5%, 0603	VISHAY, CRCW060310R0JNEA
28	1	R10	RES., CHIP, 1Ω, 1/10W, 5%, 0603	VISHAY, CRCW06031R00JNEA
29	1	R27	RES., 19.6k, 1/10W, 1%, 0603	VISHAY, CRCW060319K6FKEA
30	1	R28	RES., 75k, 1/10W, 1%, 0603	VISHAY, CRCW060375K0FKEA
31	1	R29	RES., 1M, 1/10W, 1%, 0603	VISHAY, CRCW06031M00FKEA
32	1	U1	I.C., LT8550, 52QFN	ANALOG DEVICES, LT8550EUKG#PBF
33	1	U3	I.C., REG., TSSOP28FE-EA	ANALOG DEVICES, LT8631EFE#PBF

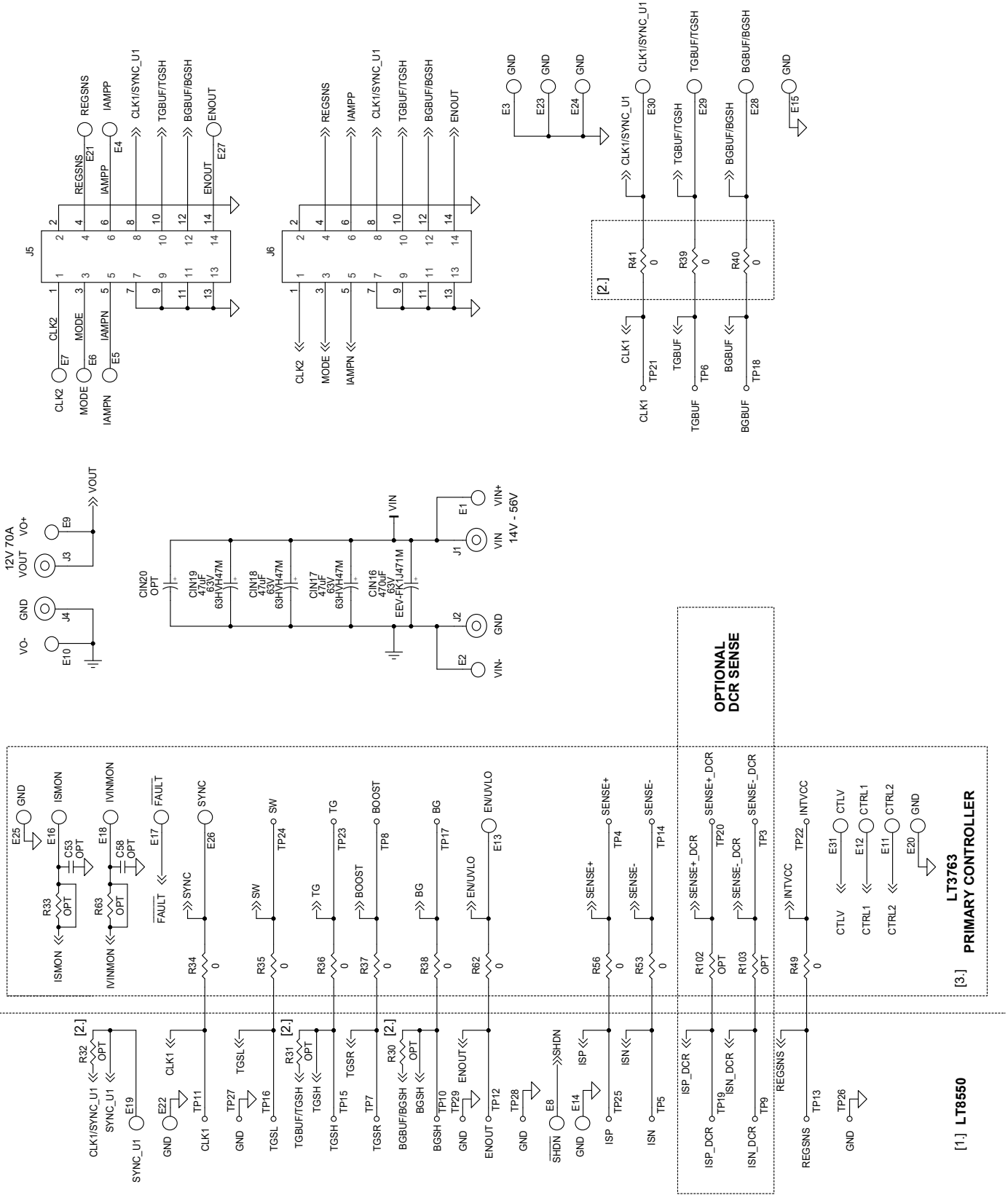
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
DC2331A-B Additional Demo Board Circuit Components				
1	0	CIN4, COUT5(OPT)	CAP., OPTION, 1210	
2	0	CIN12, CIN13(OPT)	CAP., OPTION, 2220 (J-LEAD)	
3	1	CIN16	CAP., ALUM., 470µF, 20%, 63V	PANASONIC, EEV-FK1J471M
4	0	CIN20(OPT)	CAP., ALUM., OPTION	
5	0	COUT14, COUT15(OPT)	CAP., ALUM., OPTION	
6	0	C4, C5, C14, C15, C21, C22, C25, C30, C31, C36, C37, C38, C39, C40, C41, C42, C43, C44, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C56, C57, C58, C59, C60, C61(OPT)	CAP., OPTION, 0603	
7	1	C7	CAP., X7R, 1000pF, 25V, 10%, 0603	MURATA, GRM188R71E102KA01D
8	1	C16	CAP., ALUM., 10µF, 100V, 20%	SUN ELEC., 100CE10BS
9	0	C23(OPT)	CAP., OPTION, 1206	
10	0	C29(OPT)	CAP., OPTION, 0805	
11	0	D5, D6, D7(OPT)	DIODE, SCHOTTKY, OPTION, SOD323	
12	0	D8(OPT)	DIODE, OPTION, SOD523	
13	0	L5(OPT)	IND., OPTION	
14	0	Q17, Q18, Q19, Q20(OPT)	XSTR., MOSFET, OPTION, PG-TDSON-8	
15	0	Q22(OPT)	MOSFET, OPTION, SOT223	
16	0	RSNS5, R106(OPT)	RES.,. OPTION, 2512	
17	0	RT1(OPT)	THERMISTOR, OPTION, 0603	
18	0	R1, R4, R6, R9, R11, R16, R17, R18, R19, R20, R21, R22, R24, R25, R33, R34, R35, R36, R37, R38, R39, R40, R41, R42, R43, R44, R45, R46, R47, R49, R50, R51, R52, R53, R55, R56, R57, R58, R59, R60, R62, R63, R64, R65, R66, R67, R68, R69, R70, R71, R76, R77, R78, R79, R81, R82, R84, R85, R86, R87, R88, R89, R90, R91, R92, R93, R94, R98, R99, R100, R101, R102, R103, R104, R105, R108, R109, R110, R111, R112, R113, R114, R115, R116, R117, R118, R119(OPT)	RES., OPTION, 0603	
19	11	R3, R5, R8, R30, R31, R32, R80, R95, R96, R97, R107	RES., CHIP, 0Ω, 1/10W, 1%, 0603	VISHAY, CRCW06030000Z0EA
20	1	R48	RES., 133k, 1/10W, 1%, 0603	VISHAY, CRCW0603133KFKEA
21	1	R54	RES., 10k, 1/10W, 5%, 0603	VISHAY, CRCW060310K0JNEA
22	1	R61	RES., 1M, 1/10W, 1%, 0603	VISHAY, CRCW06031M00FKEA
23	0	R72, R73, R74, R75,	RES., OPTION, 0805	
		R83(OPT)		

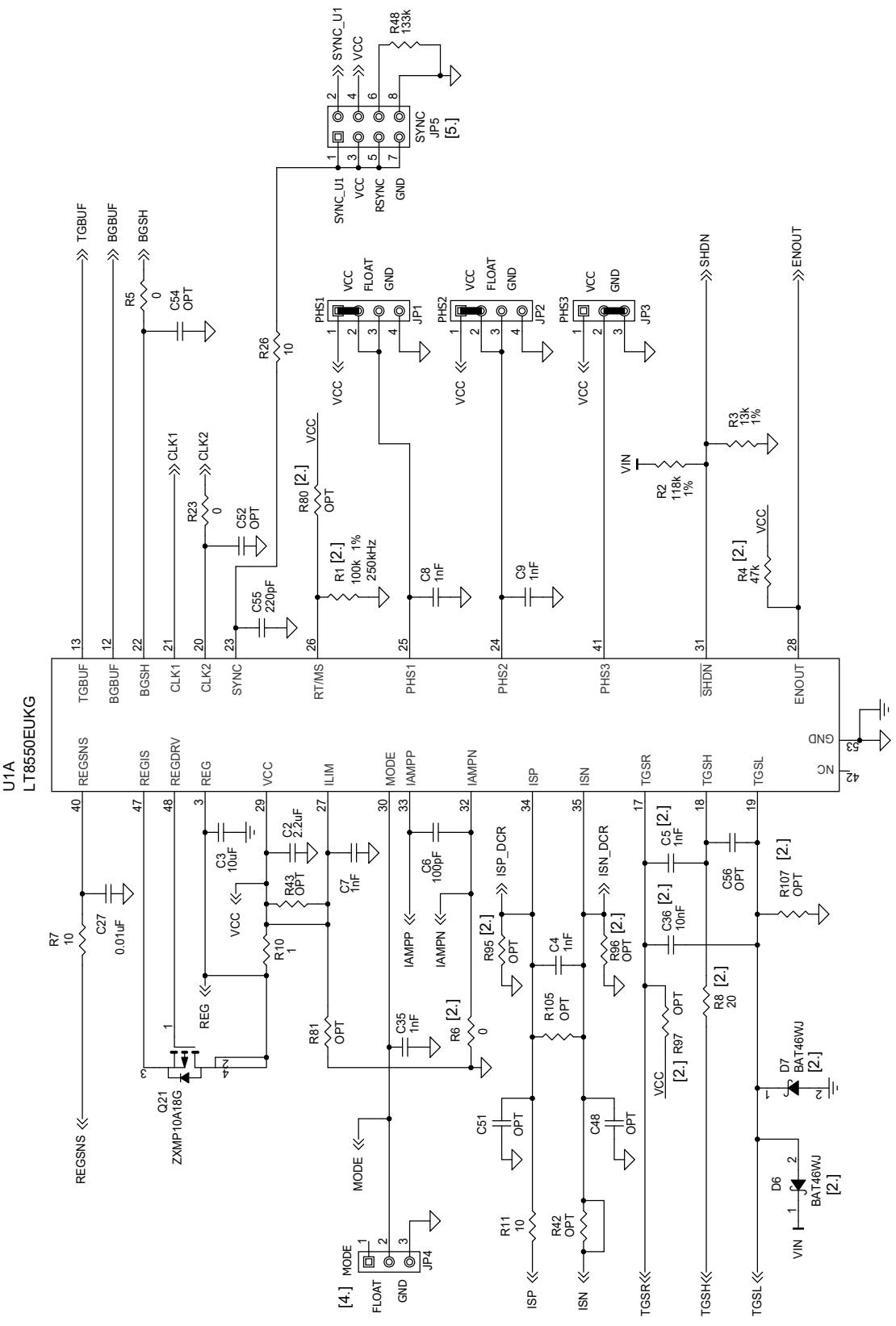
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
DC2331A-B Hardware: For Demo Board Only				
1	21	E1, E2, E3, E4, E5, E6, E7, E8, E9, E10, E14, E15, E19, E21, E22, E23, E24, E27, E28, E29, E30	TESTPOINT, TURRET, .061"	MILL-MAX, 2308-2-00-80-00-00-07-0
2	0	E11, E12, E13, E16, E17, E18, E20, E25, E26, E31(OPT)	TESTPOINT, TURRET, .061"	MILL-MAX, 2308-2-00-80-00-00-07-0
3	2	JP1, JP2	HEADER 4 PIN 0.079 SINGLE ROW	WURTH ELEKTRONIK, 62000411121
4	2	JP3, JP4	HEADER 3 PIN 0.079 SINGLE ROW	WURTH ELEKTRONIK, 62000311121
5	1	JP5	HEADER 2X4 PIN, 0.079	WURTH ELEKTRONIK, 62000821121
6	5	XJP1, XJP2, XJP3, XJP4, XJP5	SHUNT, 2mm	WURTH ELEKTRONIK, 60800213421
7	4	J1-J4	STUD, TEST PIN	PEM, KFH-032-10ET
8	8	(J1-J4)	NUT, BRASS NUTS # 10-32	ANY, 10-32M/S BR PL
9	12	(J1-J4)	RING, LUG RING # 10	KEYSTONE, 8208
10	4	(J1-J4)	WASHER, TIN PLATED BRASS	ANY, #10EXT- BZ TN
11	2	J5, J6	HEADER, 2X7PIN, 0.079"	MOLEX, 87831-1420
12	4	MH1-MH4	STAND-OFF, NYLON 1.0"	WURTH ELEKTRONIK, 702939000
13	1		CABLE ASSY., 8" STRIP	MMT PRECISION CORP., CA-2440

SCHEMATIC DIAGRAM



SCHEMATIC DIAGRAM



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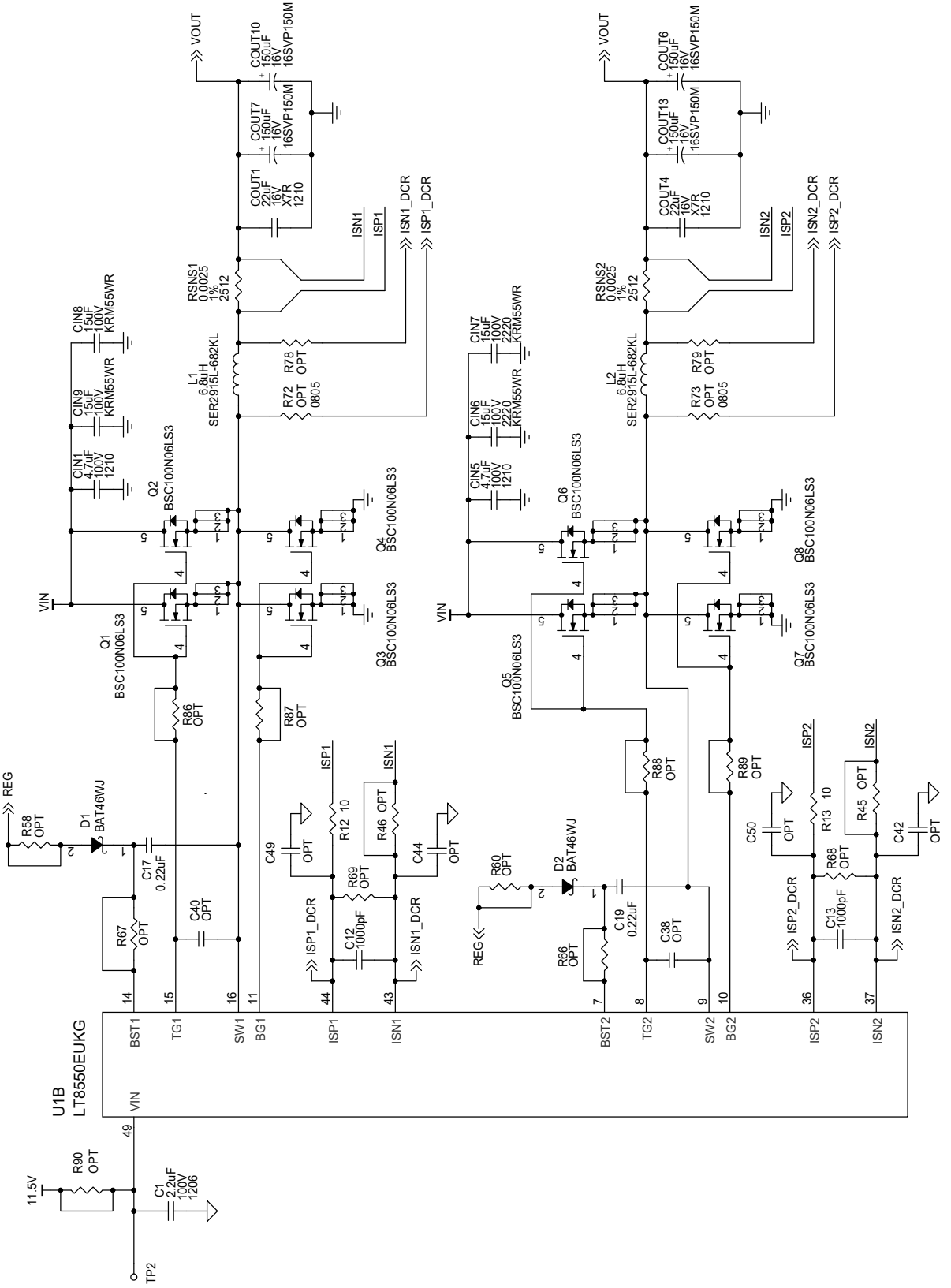

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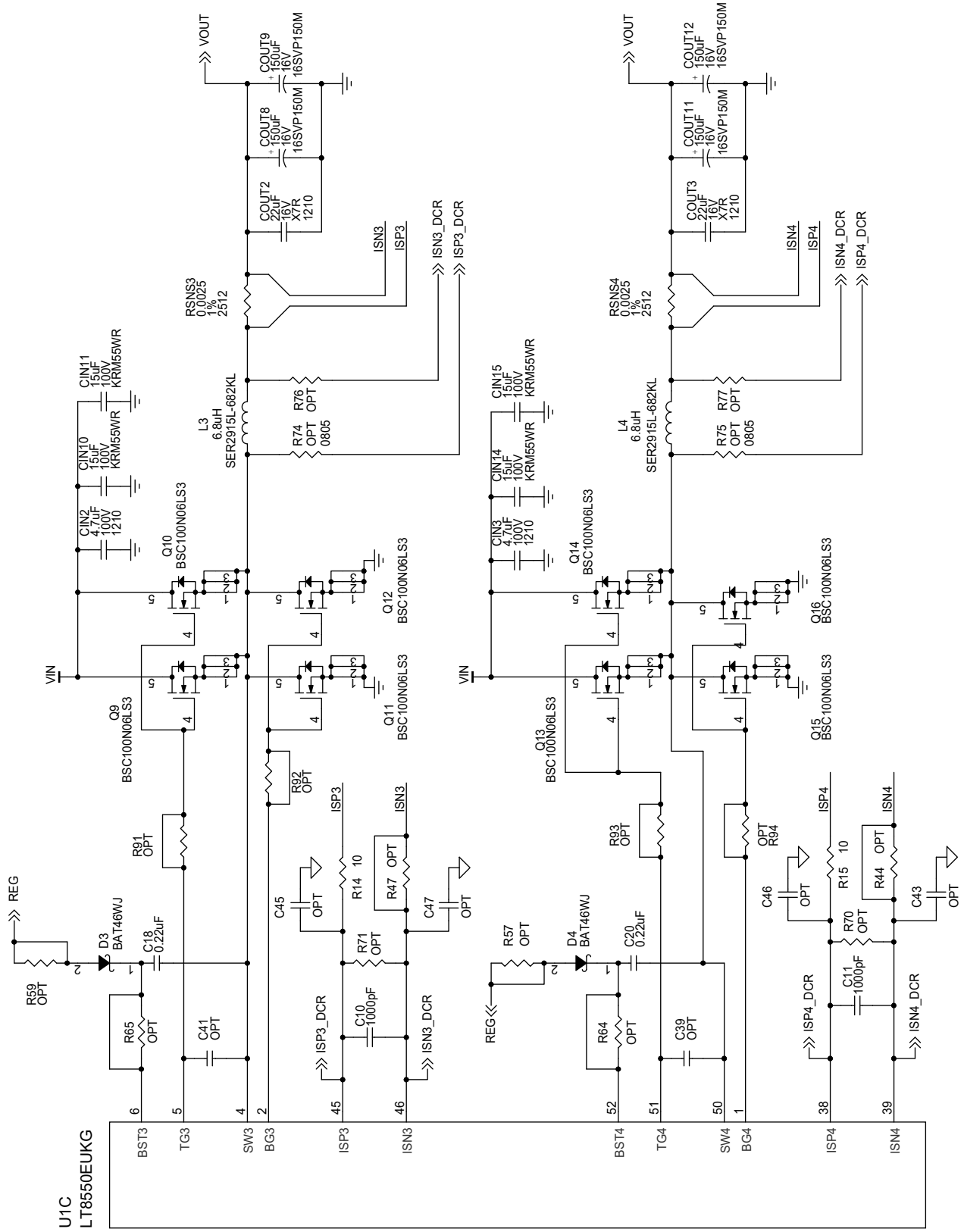

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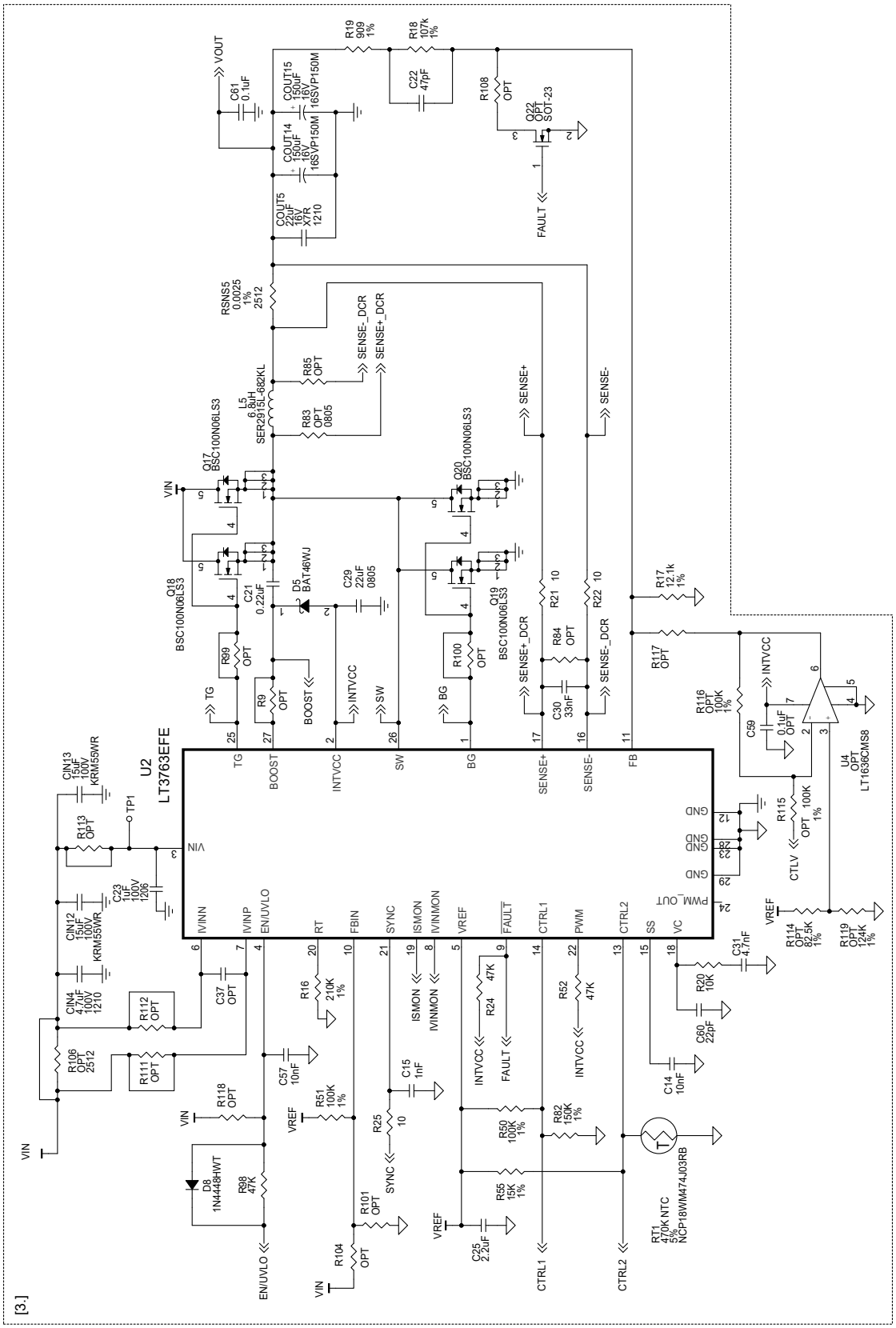

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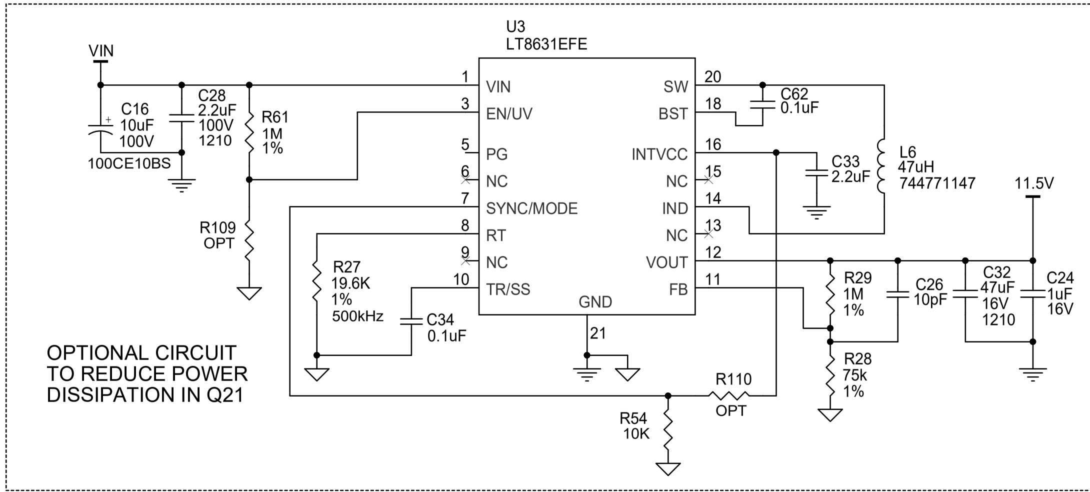

NOTES:

[1.]

ASSY	LT8550 MASTER / SLAVE
-A	MASTER
-B	SLAVE

[2.]

ASSY	R1	R4	R6,R39,R40,R41	R8	R30,R31,R32,R80, R95.R96,R97,R107	C5	C36	D6,D7
-A	100K	47K	0 OHM	20	OPT	1nF	10nF	BAT46WJ
-B	OPT	OPT	OPT	0 OHM	0 OHM	OPT	OPT	OPT

[3.]

ASSY	LT3763 PRIMARY CONTROLLER COMPONENTS INSTALLED / REMOVED
-A	INSTALLED
-B	REMOVED

[4.]

ASSY	JP4 MODE FLOAT / GND
-A	GND
-B	FLOAT

[5.]

ASSY	JP5 SYNC SYNC_U1 / VCC / RSYNC / GND
-A	GND
-B	SYNC_U1

6. UNLESS OTHERWISE SPECIFIED,
ALL RESISTORS ARE 0603, 5%
AND ALL CAPACITORS ARE 0603.

Rev. 0

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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