LTC4223 Dual Supply Hot Swap Controller for µTCA Mezzanine Cards

DESCRIPTION

Demonstration circuit board 1162A allows easy evaluation of the performance of the LTC4223 Dual Hot Swap Controller for Advanced Mezzanine (AMC) Cards. This controller is designed for applications in equipment satisfying the Micro Telecommunications Computing Architecture Specification requirements (+12V main rail with load capability up to 9A and +3.3V auxiliary rail with 150mA load capability). DC1162A includes two printed circuit boards: A simulated carrier board with the LTC4223, 170-pin AMC connector, passive components, and turrets for both rails. The second board is a simulated AMC mezzanine card, with the same +12V and +3.3V rail outputs as the carrier board. This board also has a typical amount of bypass capacitance onboard, and more may be added externally.

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

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PERFORMANCE SUMMARY

Specification s are at T_A = 25°C

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{DD}	Input Supply Range	Vcc	2.7		6.0	V
		AUXIN	2.7		6.0	V
		$12V_{IN}$	10		14	V
$V_{DD(UVLO)}$	Input Supply Undervoltage Lockout	Vcc Rising	2.3	2.45	2.6	V
		AUXIN Rising	2.4	2.5	2.6	V
		$12V_{IN}$ Rising	9.4	9.7	10	V
$\Delta V_{SENSE(CB)}$	Circuit Breaker Trip Sense Voltage (V_{12IN} -$V_{12SENSE}$)		47.5	50	52.5	mV
$\Delta V_{SENSE(ACL)}$	Active Current Limit Sense Voltage, (V_{12IN} -$V_{12SENSE}$)	V_{IN} = 3.6V	54	60	66	mV
$I_{AUX(ACL)}$	AUXOUT Active Current Limit	V_{AUXOUT} =)V	165	240	330	mA
ΔV_{GATE}	External N-Channel Gate Drive ($V_{12VGATE}$-V_{12VOUT})		4.4	6.2	7.9	V
$I_{GATE(UP)}$	External N-Channel Gate Pull-Up Current	Gate Drive On, $V_{12VGATE}$= 0V	-7	-10	-14	uA
$I_{GATE(DN)}$	External N-Channel Gate Pull-Down Current	Gate Drive Off, $V_{12VGATE}$=17V, V_{12VOUT}= 12V	0.5	1	2	mA
$I_{GATE(FPD)}$	External N-Channel Gate Fast Pull-Down Current	Fast Turn Off, $V_{12VGATE}$=17V, V_{12VOUT}= 12V	90	160	250	mA
G_{12IMON}	12IMON Pin Gain Ratio $\Delta V_{12IMON}/\Delta(V_{12VIN}$-$V_{12VSENSE})$	(V_{12VIN}-$V_{12VSENSE}$)=(75mV, 25mV)	30	33	36	V/V
V_{12IMON}	12IMON Pin Output Voltage	(V_{12VIN}-$V_{12VSENSE}$)=75mV, V_{CC} =2.7V	2.25	2.475	2.7 2.6	V

OPERATING PRINCIPLES

The LTC4223 is a dual Hot Swap Controller that satisfies the power requirements and power management of equipment developed in accordance with Advanced Mezzanine Card or MicroTCA specifications. It controls the +12V main supply and +3.3V auxiliary supply power through N-channel MOSFETs. The main power MOSFET is an external component and the auxiliary power MOSFET is integrated in the Controller.

These two rails can be turned on and off independently by their respective ON control signals.

The LTC4223 provides a rich set of features to support hot swap application including:

- Undervoltage lockout on both rails and Vcc,
- Integrated 0.3 Ohm AUX MOSFET,
- Fast (less than 1us) Peak Fault Current limit,
- Circuit Breaker function on Both rails
- Adjustable main rail Current Limit,
- Main rail Load Current Monitoring,
- Gate Drive for External N-Channel MOSFET,
- Adjustable Response Time for Overcurrent Protection,
- Adjustable Supply Voltage Power-Up Rate,
- Thermal Shutdown Protection,
- LTC4223-1: Latch Off After Fault,
- LTC4223-2: Automatic Retry After Fault.

QUICK START PROCEDURE

Demonstration circuit 1162 is easy to set up to evaluate the performance of the LTC2208. Insert the daughter board into the connector. Refer to Figure 1 for proper measurement equipment setup. In the first part of the test, use main board turrets to connect load and voltmeters

1. Place jumpers in the following positions:

JP1	12ON	ON
JP2	VCC_SEL	AUX
JP3	AUXON	ON
JP4	EXT PRESENCE	EXT
JP5	RST	EXT

2. With power off, connect the power supplies to 12IN, AUXIN, and GND turrets.
3. Disable electronic loads and connect the appropriate terminals to the 12OUT, AUXOUT, and GND turrets.
4. Connect voltmeters to control signals on the $\overline{\text{FAULT}}$, $\overline{\text{12PGOOD}}$, 12MON, and $\overline{\text{AUXPGOOD}}$ turrets.
5. Turn on the 12V and 3.3V supplies. Seven main board green LEDs D4 (12VOUT), D8 (AUXOUT), D5 ($\overline{\text{12PGOOD}}$), D7 ($\overline{\text{AUXPGOOD}}$), D1 (12VIN), D2 (AUXIN), D3 (Vcc), and three daughter board LEDs D11 (12PP), D13 (3.3MP), and D12 (SYS_ENABLE) should light.

   Turn on the electronic loads and verify the circuit breaker thresholds: (8.33±0.8) A for 12V rail, and (240±90)mA for the 3.3V rail. In this test, verify that a fault on the +12V rail latches only the +12V rail, ($\overline{\text{FAULT}}$) pulls low, $\overline{\text{12VPGOOD}}$ goes high, $\overline{\text{AUXPGOOD}}$ stays low. To reset the fault, pull 12VIN low and then high. A fault on the +3.3V rail latches off both 3.3V and 12V rails. FAULT pulls low, 12VPGOOD and AUXPGOOD go high. To reset the fault, pull both 12ON and AUXON low and than high.

   There is an option in using external signals for ON inputs, and Vcc. Change the jumper JP1, JP2, and JP3 position as

JP1	12ON	EXT
JP2	VCC_SEL	EXT
JP3	AUXON	EXT

   Use appropriate voltage sources to drive 12ON(E5), AUXIN(E6), EXTVcc(E7), and AUXON(E8) turrets.
6. Reconnect the loads to the daughter board turrets and verify that the LTC4223 demonstrates the same performance. The daughter board also allows observation of turn-on transients when it is plugged into a live carrier board.

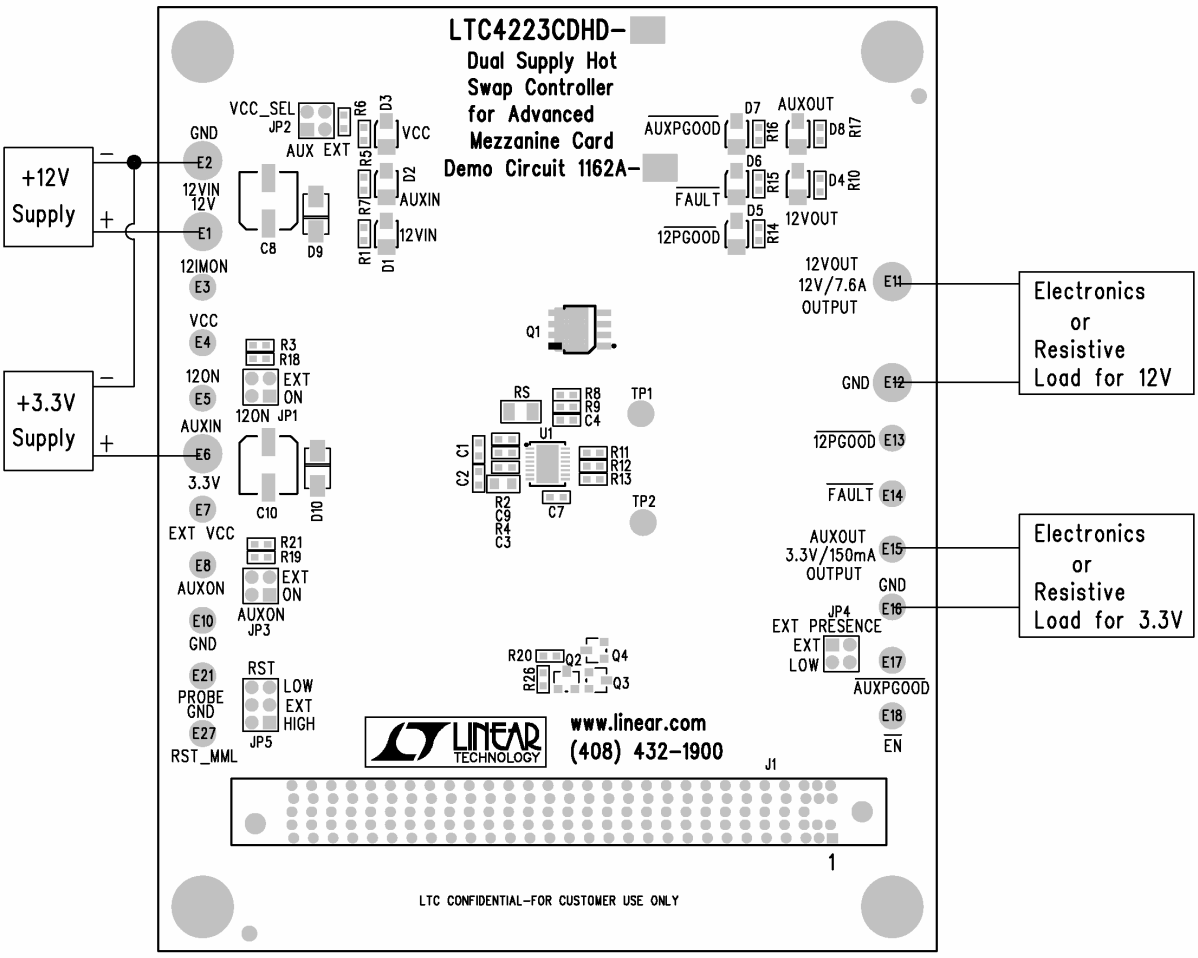
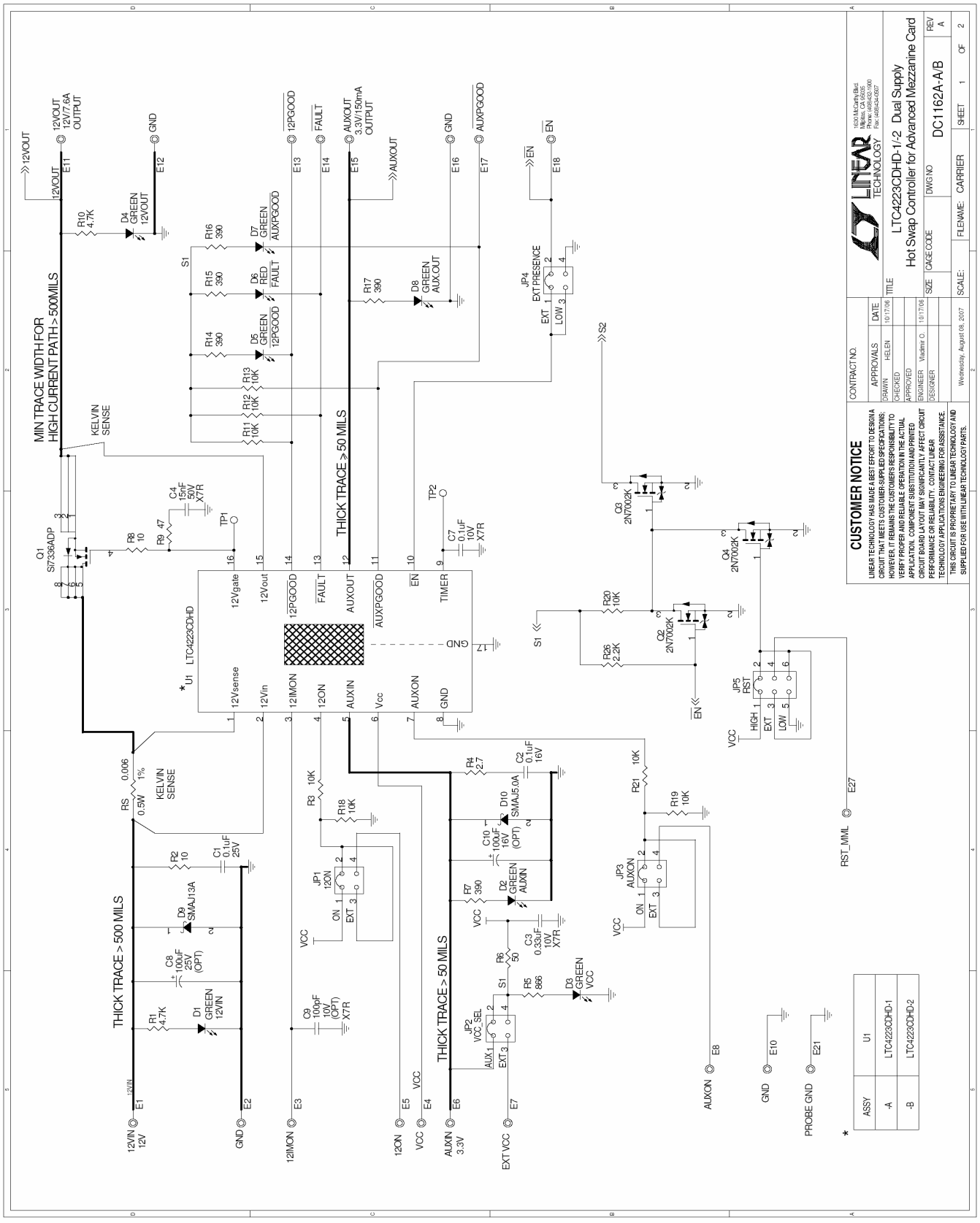


Figure 1. Measurement Equipment Setup


MIN TRACE WIDTH FOR HIGH CURRENT PATH > 500MILS
THICK TRACE > 500 MILS
THICK TRACE > 50 MILS
THICK TRACE ≥ 50 MILS
KELVIN SENSE
LTC4223CDHD
Q1 SI7336ADP
RS 0.006 1% 0.5W
R1 4.7K
R2 10
R3 10K
R4 2.7
R5 866
R6 50
R7 390
R8 10
R9 47
R10 4.7K
R11 10K
R12 10K
R13 10K
R14 390
R15 390
R16 390
R17 390
R18 10K
R19 10K
R20 10K
R21 10K
R26 2.2K
C1 0.1uF 25V
C2 0.1uF 16V
C3 0.33uF 10V X7R
C4 15nF 50V X7R
C7 0.1uF 10V X7R
C8 100uF 25V (OPT)
C9 100pF 10V (OPT) X7R
C10 100uF 16V (OPT)
D1 GREEN 12VIN
D2 GREEN AUXIN
D3 GREEN VCC
D4 GREEN 12VOUT
D5 GREEN 12PGOOD
D6 RED FAULT
D7 GREEN AUXPGOOD
D8 GREEN AUXOUT
D9 SMAJ13A
D10 SMAJ5.0A
Q2 2N7002K
Q3 2N7002K
Q4 2N7002K
JP1 12ON
JP2 VCC_SEL
JP3 AUXON
JP4 EXT PRESENCE
JP5 RST
S1
S2
TP1
TP2
12VOUT 12V/7.6A OUTPUT
AUXOUT 3.3V/150mA OUTPUT
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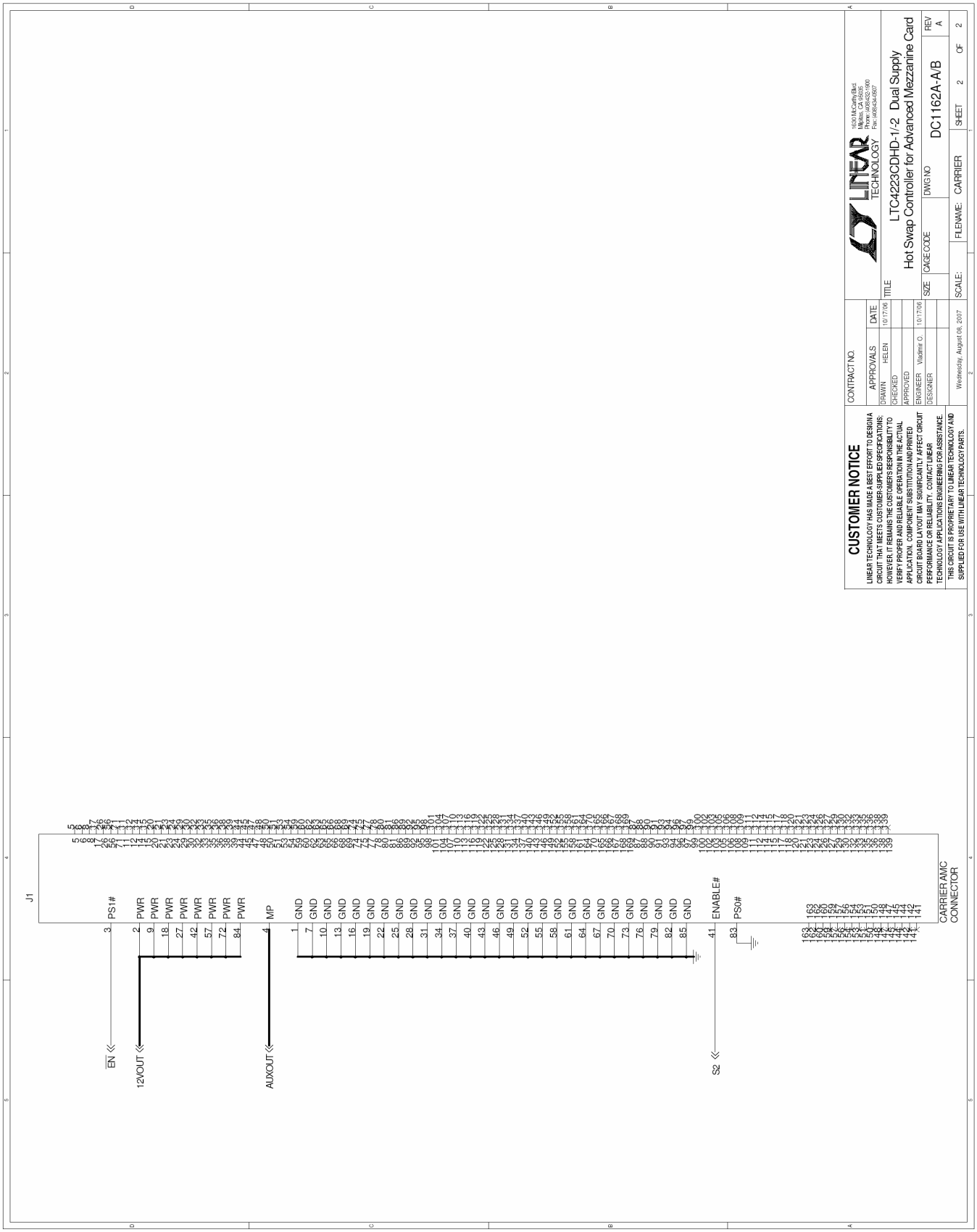
LINEAR TECHNOLOGY
LTC4223CDHD-1/-2 Dual Supply Hot Swap Controller for Advanced Mezzanine Card
DC1162A-A/B
ASSY U1
-A LTC4223CDHD-1
-B LTC4223CDHD-2


J1
CARRIER AMC CONNECTOR
PS1#
PWR
MP
GND
ENABLE#
PS0#
EN
12VOUT
AUXOUT
S2
CUSTOMER NOTICE
LINEAR TECHNOLOGY HAS MADE A BEST EFFORT TO DESIGN A CIRCUIT THAT MEETS CUSTOMER-SUPPLIED SPECIFICATIONS; HOWEVER, IT REMAINS THE CUSTOMERS RESPONSIBILITY TO VERIFY PROPER AND RELIABLE OPERATION IN THE ACTUAL APPLICATION. COMPONENT SUBSTITUTION AND PRINTED CIRCUIT BOARD LAYOUT MAY SIGNIFICANTLY AFFECT CIRCUIT PERFORMANCE OR RELIABILITY. CONTACT LINEAR TECHNOLOGY APPLICATIONS ENGINEERING FOR ASSISTANCE.
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CONTRACT NO.
APPROVALS
DATE
DRAWN HELEN 10/17/06
CHECKED
APPROVED
ENGINEER Vladimir O. 10/17/06
DESIGNER
Wednesday, August 08, 2007
SCALE:
TITLE
LTC4223CDHD-1/-2 Dual Supply Hot Swap Controller for Advanced Mezzanine Card
SIZE
CAGE CODE
DWG NO
DC1162A-A/B
REV A
FILENAME: CARRIER
SHEET 2 OF 2
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