LT4200
12V, 50A Hot Swap E-Fuse

DESCRIPTION

Demonstration circuit 3024A showcases the LT®4200 50A hot swap E-fuse with guaranteed SOA. Included on the board are input voltage dividers for undervoltage and overvoltage protection, LEDs to indicate input voltage, output voltage, fault and power bad conditions, and jumpers to enable auto retry and to select circuit breaker delay. Turrets are provided for monitoring input voltage, output voltage, output status, and most of the pins on the LT4200.

Design files for this circuit board are available.

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	MIN	TYP	MAX	UNITS
Input Supply Voltage Range (After Startup)	10	12	14.4	V
VIN DC Survival (Limited by D3)		18		V
Undervoltage Lockout (Voltage Falling)		9.24		V
Undervoltage Lockout Release (Voltage Rising)		9.88		V
Overvoltage Lockout (Voltage Rising)		15.19		V
Output Load Current			50	A
Load Capacitance			7666	µF
Electronic Circuit Breaker Delay		0.5 or 1		ms

QUICK START PROCEDURE

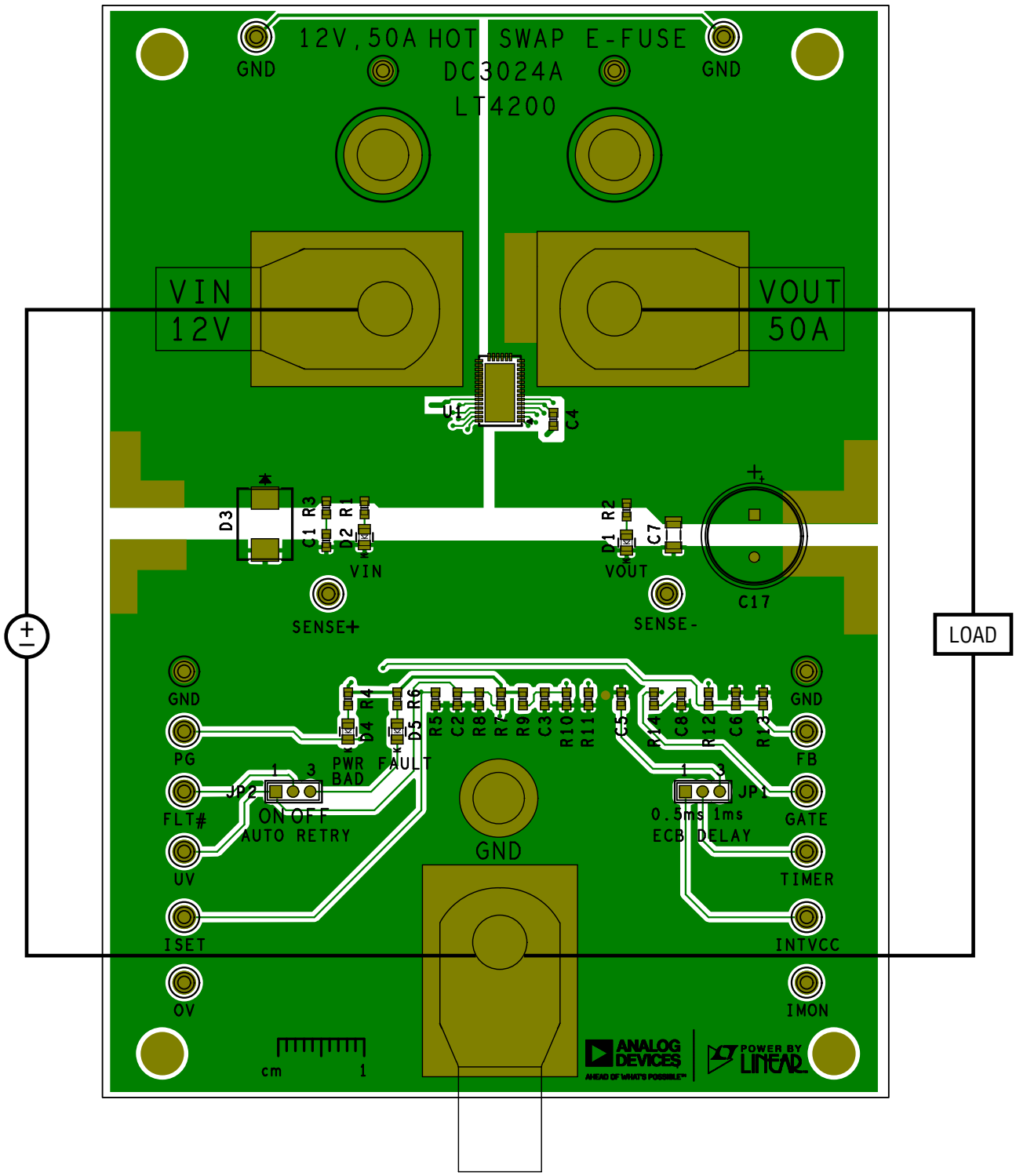

Figure 1. Measurement Equipment Setup

QUICK START PROCEDURE

Table 1. Power Connections

NOMENCLATURE	DESCRIPTION
VIN	12V Input
VOUT	50A Output
GND	Input and Output Return

Table 2. Test Points

NOMENCLATURE	DESCRIPTION
SENSE+	$SENSE^+$ Pin Monitor
GND	Return Monitor
PG	PG Pin Monitor
FLT#	FLT# Pin Monitor
UV	UV Pin Monitor
ISET	ISET Pin Monitor
OV	OV Pin Monitor
IMON	IMON Pin Monitor
INTVCC	$INTV_{CC}$ Pin Monitor
TIMER	TIMER Pin Monitor
GATE	GATE Pin Monitor
FB	FB Pin Monitor
SENSE–	$SENSE^-$ Pin Monitor

QUICK START PROCEDURE

Table 3. LED Indicators

NOMENCLATURE	PART DESIGNATOR	DESCRIPTION
VOUT	D1 (Green)	Output Voltage Present
VIN	D2 (Green)	Input Voltage Present
PWR BAD	D4 (Red)	VOUT Below Power Good Threshold
FAULT	D5 (Red)	Overcurrent Fault

Table 4. Jumpers

NOMENCLATURE	PART DESIGNATOR	DESCRIPTION
AUTO RETRY	JP2	Use ON Position for Auto Retry
ECB DELAY	JP1	0.5ms or 1ms Timer Duration

QUICK START PROCEDURE

DC3024A is easy to set up to evaluate the performance of the LT4200. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below.

DC3024A has two user configurable jumper options:

- JP2, AUTO RETRY – Set to ON for auto retry or OFF for latch off on overcurrent faults (Default position: OFF).
- JP1, ECB DELAY – Set to 0.5ms for the internal 0.5ms timer or 1ms determined by C5. C5 may be replaced for other timer durations (Default position: 0.5ms).

LEDs indicate the state of input power (D2), output power (D1), fault (D5), and powerbad (D4). Load current can be monitored on the IMON turret, which has a value of 0.04V/A determined by R_{MON} (i.e. R11 = 20k).

Set an adjustable power supply, capable of supplying 60A at 16V. Turn off power and connect the supply to VIN and GND. Use the high current connectors provided on the board for currents >10A. Connect a suitable load to VOUT and GND. This load can be an electronic load or power resistors capable of dissipating 600W.

NOTE: Because the LT4200 incorporates foldback current limiting, the nominal startup current supplied to the load is approximately 6.8A and may be as low as 4.6A. This current limit increases linearly until the FB pin exceeds 1V (V_{OUT} > 8.5V). An electronic constant current load set to >4.6A will not permit the circuit to turn on unless it is gated on by the PG signal (as would be the case with a DC/DC converter controlled by the PG signal).

Turn on the power supply; verify the input voltage is 12V. Verify the output voltage; D2 (VIN) and D1 (VOUT) should both be illuminated and both D5 (FAULT) and D4 (PWR BAD) should be off. On power-up, observe the slope of VOUT. This should be in the range of 0.15V/ms to 0.6V/ms, corresponding to a ramp-up time of 20ms to 80ms for 12V. With the circuit functioning, additional evaluations can now be performed.

OV/UV/PG Thresholds

Set the input supply to zero and ramp the voltage slowly, observing the following events. Above 10V, the circuit will be out of UV lockout and the output should ramp up, turning on D1. Above 10.5V, the FB pin will be above its threshold, asserting the PG pin high and turning off D4. Increasing the supply past 15.2V will engage OV lockout; D1 will turn off and D4 will turn on.

Current Limit Thresholds

With the input supply set to 12V, load the output with a 0.3Ω power resistor capable of dissipating 600W. Power should remain on, as the current will be below the 50A minimum current limit threshold. LT4200 temperature rises to 80°C with 50A current flow. Next, load the output with a <0.2Ω power resistor. Power should be interrupted, as the current will be above the 57A maximum current limit threshold. D5 will turn on, indicating an overcurrent fault.

Inrush into Capacitive Load

One of the main functions of a hot swap circuit is to provide controlled power ramp-up into a capacitive load to avoid disturbing the input power supply. To guarantee that current limit is never reached during ramp-up into a capacitor, the current must be less than the minimum current limit threshold of 4.6A when the gate ramp rate is at its maximum value of 0.6V/ms. (Note that the minimum current limit threshold occurs when the FB pin is at 0V.)

$$C = i/(dV/dt) = 4.6A/(0.6V/ms) = 7666\mu F$$

Thus, the circuit will always power up successfully with a 7666µF capacitor at VOUT, and observation of the TIMER turret post will show that it never begins to ramp.

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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