LTC4217
2A Integrated Hot Swap Controller

DESCRIPTION

Demonstration circuit 1051A includes two separate circuits for performance evaluation of the LTC®4217 2A integrated Hot Swap™ controller. This integrated circuit includes a power MOSFET to save board area and to minimize external component count. The standard version of the controller (LTC4217) is intended to operate with 2.9V to 26.5V rails, while the LTC4217-12 has internal adjustment for 12V applications.

The circuit of DC1051A located on the upper board area is assembled with the LTC4217 configured for operation with a 24V rail. The lower circuit includes the LTC4217-12. Current limit features of both circuits are identical, with 5% accuracy and a distinctive foldback property.

The LTC4217 features a ground-referred current monitor. The current monitor sources a current that is proportional to the sense voltage and it may be converted to a voltage signal with an appropriate resistor.

The current limit may be reduced by placing an external resistor between GND and the ISET pin.

The DC1051A schematic allows the LTC4217 to operate in turn-on and turn-off modes as well as in the steady-state mode with different loads, and in the fault mode.

The LTC4217 features an overtemperature protection circuit, and protects the load from overvoltage and undervoltage conditions.

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

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
24V Circuit						
V_{DD}	Input Supply Range	Typical Value	19.9	24	26.3	V
$V_{DD(UVL)}$	Input Supply Undervoltage Range	V_{DD} Rising	19.12	19.9	20.30	V
$V_{DD(OVH)}$	Input Supply Overvoltage Range	V_{DD} Rising	25.32	26.3	27.38	V
t_{TIMER}	Timer Period		0.9	1.235	1.76	ms
I_{LIM}	Current Limit Value	V_{FB} = 1.235V (V_{OUT} in the Range 20.3V to 21.2V)	1.9	2	2.1	A
		V_{FB} = 0V to 0.15V (V_{OUT} in the Range 0V to 2.5V)	0.35	0.5	0.7	A
C_{MAX24}	Maximal Load Capacitance	For Successful Power-Up		900		µF
C_{MIN24}	Minimal Load Capacitance	For Unsuccessful Power-Up		3500		µF
12V Circuit						
V_{DD}	Input Supply Range	Typical Value	9.88	12	15.05	V
$V_{DD(UVL)}$	Input Supply Undervoltage Range	V_{DD} Rising	9.6	9.88	10.2	V
$V_{DD(OVH)}$	Input Supply Overvoltage Range	V_{DD} Rising	14.7	15.05	15.4	V
t_{TIMER}	Timer Period	V_{TIMER} Rising	0.9	1.235	1.76	ms
I_{LIM}	Current Limit Value	V_{FB} = 1.235V (V_{OUT} in the Range 10.15V to 10.6V)	1.9	2	2.1	A
		V_{FB} = 0V to 0.15V (V_{OUT} in the Range 0V to 1.15V)	0.35	0.5	0.7	A
C_{MAX12}	Maximal Load Capacitance	For Successful Power-Up		1000		µF
C_{MIN12}	Minimal Load Capacitance	For Unsuccessful Power-Up		4000		µF

OPERATING PRINCIPLES

The LTC4217 is suited for low voltage applications such as hot board insertion and removal. The LTC4217 has a rich set of features to support Hot Swap applications including:

- Integrated power MOSFET for a compact Hot Swap solution
- 2% accurate undervoltage and overvoltage protection
- Adjustable 5% accurate current limit
- Adjustable inrush current control
- Load current monitoring
- Adjustable current limit timer before power is turned off
- Power good signaling

QUICK START PROCEDURE

Demonstration circuit 1051 is easy to set up to evaluate the performance of the LTC4217. Refer to Figure 1 for the proper measurement equipment setup and follow the procedure below.

For the 24V circuit:

1. Place jumpers in the following positions:

   JP1 $\overline{\text{FAULT}}$ Signal

   JP2 AUX_UV ON

2. With power off, connect the 24V power supply terminals to the $24V_{IN}$ (E1) and GND (E3) turrets.
3. Turn on the 24V supply and verify the output voltage between the V_{OUT} (E7) and GND (E8) turrets. Two green LEDs, $24V_{IN}$ (D2) and V_{OUT} (D6), should light up.
4. Check the current limit using an electronic or resistive load. It should be in the range of 1.9A to 2.1A if an overcurrent condition occurs while the output is high (after powering up properly). If the output is shorted initially, the load current will be limited in the range of 0.475A to 0.525A due to the foldback characteristic. Current may be monitored on the IMON test point during this measurement. The IMON signal scale is 1V/A.

   An overcurrent condition is indicated by red LED $\overline{\text{FAULT}}$ (D3) and red LED PG (D4).
5. Check the output voltage slew rate with an oscilloscope, without a load connected. It takes 43.6ms to 160ms for the output voltage to power up completely.
6. Use a 900µF capacitive load to demonstrate that power up mode completes successfully. Use a current probe to verify that inrush current is limited initially by the foldback characteristic and later by the low output voltage slew rate.
7. Use a 3500µF capacitive load to demonstrate that the part not only enters into the current limit state but operates in this state until the timer period expires.

For the 12V circuit:

8. Place jumpers in the following positions:

   JP3 $\overline{\text{FAULT}}$ Signal

   JP4 AUX_UV ON

9. With power off, connect the 12V power supply terminals to the $12V_{IN}$ (E9) and GND (E12) turrets.
10. Turn on the 12V supply and verify the output voltage at the V_{OUT} (E15) and GND (E16) turrets. Green LEDs $12V_{IN}$ (D8) and V_{OUT} (D12) should light.
11. Check the current limit using an electronic or resistive load. It should be in the range of 1.9A to 2.1A. During this measurement verify the current monitor performance. The monitor signal related to the current limit level should be 1.9V to 2.1V.
12. Check the output voltage slew rate with an oscilloscope, without a load connected. It should take from 21ms to 80ms for the output voltage to rise to 12V.

QUICK START PROCEDURE

13. Use a 1000µF capacitive load to demonstrate that the part powers up without fault. Use a current probe to observe that inrush current is limited by the low output voltage slew rate.

14. Use a 4000µF capacitive load to demonstrate that the part enters the current limit state, and operates in this state until the timer period expires. The $\overline{\text{FAULT}}$ red LED (D9) indicates this state accompanied by the PG red LED, which shows that the output voltage is lower than the power good level.

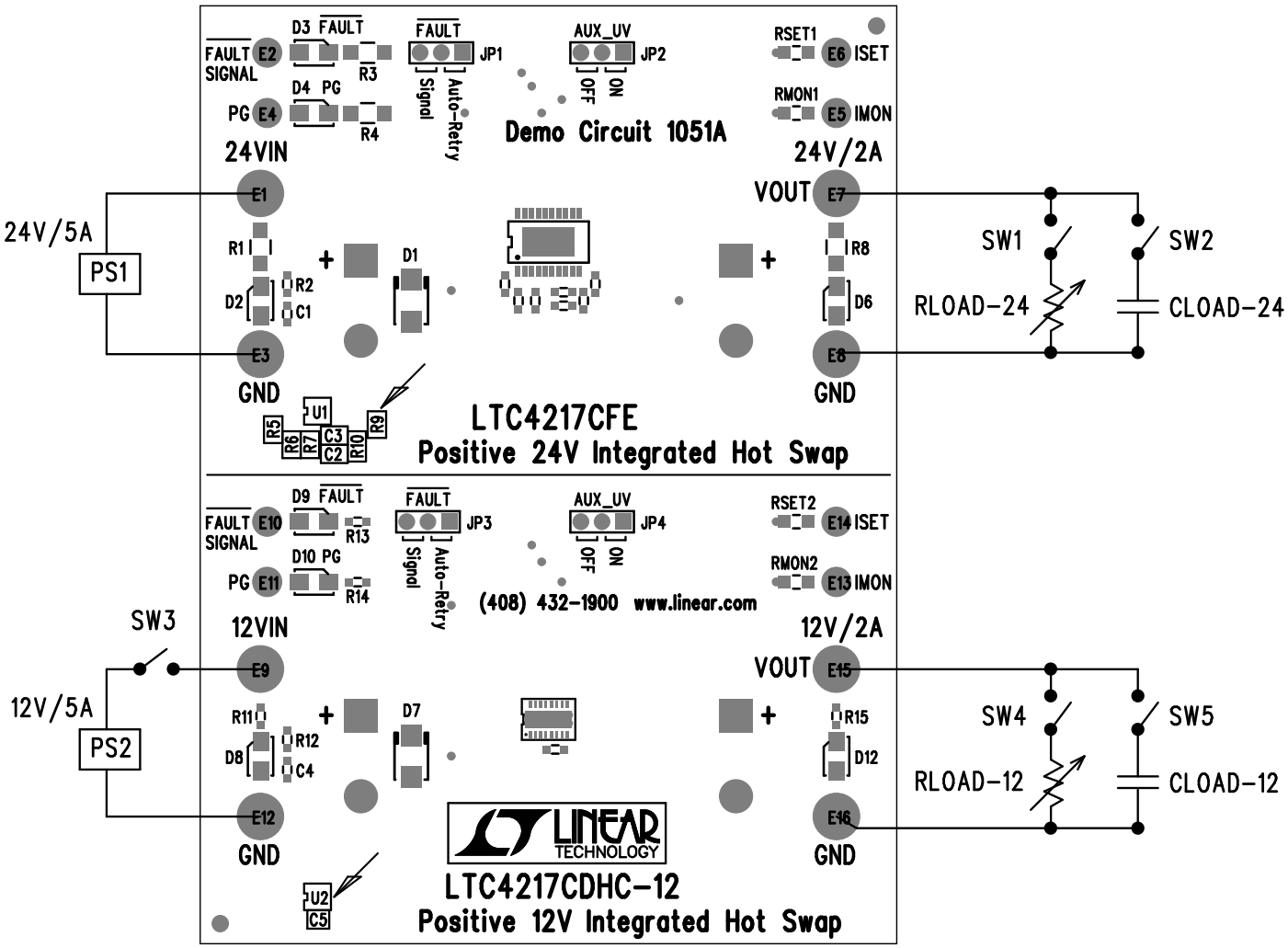
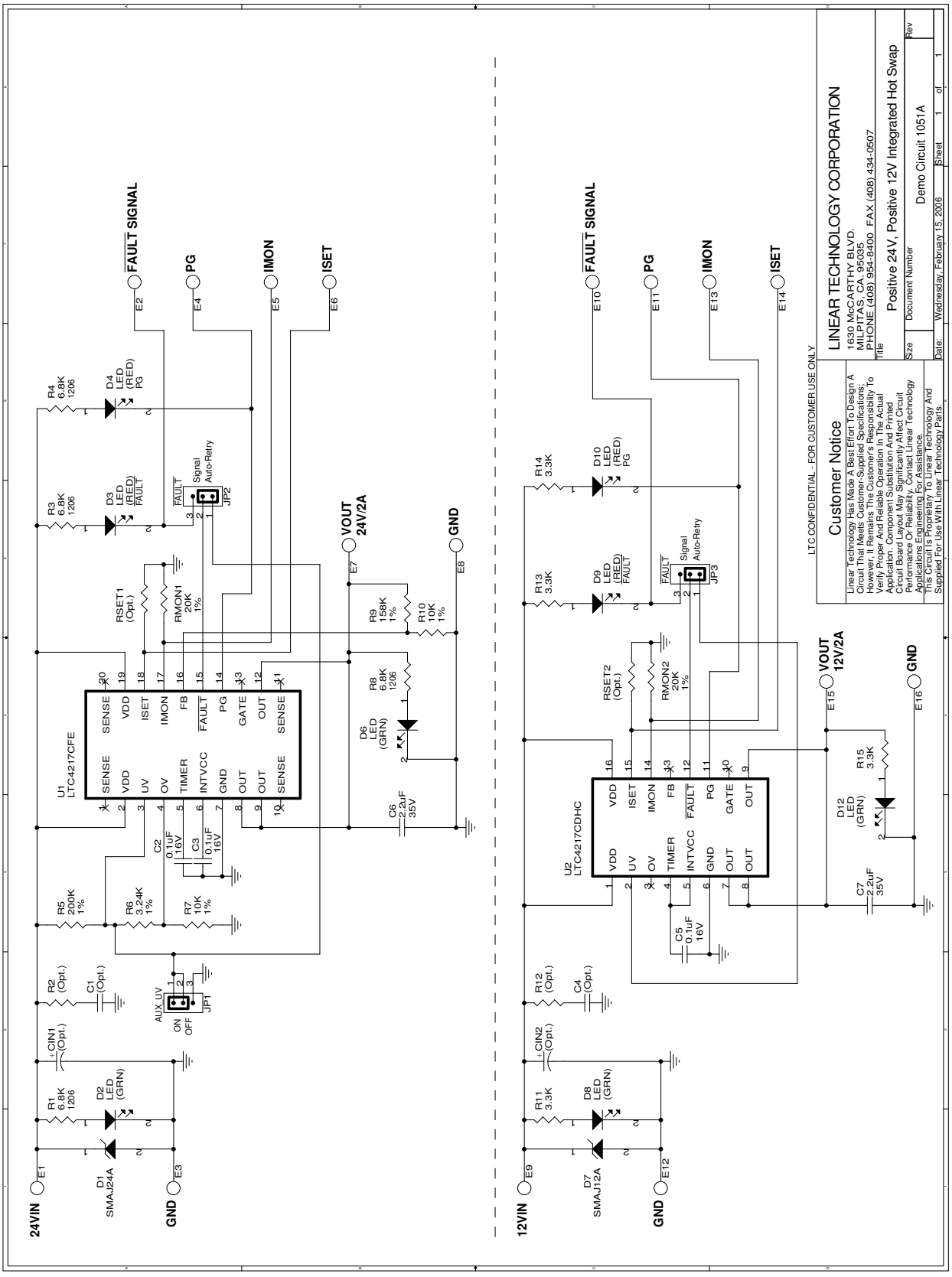


Figure 1. Measurement Equipment Setup

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
1	3	C2, C3, C5	CAP., CER X7R 0.1µF 16V 0603	AVX 0603YC104KAT2A
2	0	C1, C4, CIN1, CIN2, COUT1, COUT2	OPTIONAL	
3	8	E2, E4, E5, E6, E10, E11, E13, E14	TURRET, TEST PIN, .061"	MILL-MAX 2308-2-00-44
4	8	E1, E3, E7, E8, E9, E12, E15, E16	TURRET, TEST PIN, .095"	MILL-MAX 2501-2
5	4	JP1 - JP4	JUMPER, 0.079, 3PIN	SAMTEC, TMM-103-02-L-S
6	4	JP1 - JP4	SHUNT	SAMTEC, 2SN-BK-G
7	4	D3, D4, D9, D10	LED, SMT RED	PANASONIC, LN1251C
8	4	D2, D6, D8, D12	LED, SMT GREEN	PANASONIC, LN1351C
9	1	D1	DIODE, 400W TRANSIENT VOLTAGE SUPPRESSOR	DIODES INC., SMAJ24A
10	1	D7	DIODE, 400W TRANSIENT VOLTAGE SUPPRESSOR	DIODES INC., SMAJ12A
11	1	R6	RES., CHIP, 3.24k 1/16W 1% 0603	VISHAY, CRCW06033K24FKTA
12	4	R11, R13, R14, R15	RES., CHIP, 3.30k 1/16W 5% 0603	VISHAY, CRCW06033K30JEA
13	4	R1, R3, R4, R8	RES., CHIP, 6.80k 1/4W 5% 1206	VISHAY, CRCW12066K80JNEA
14	2	R7, R10	RES., CHIP, 10k 1/16W 1% 0603	VISHAY, CRCW060310K0FEA
15	2	RMON1, RMON2	RES., CHIP, 20k 1/16W 5% 0805	VISHAY, CRCW080520K0JEA
16	1	R9	RES., CHIP, 158k 1/16W 1% 0603	VISHAY, CRCW0603158KFEA
17	1	R5	RES., CHIP, 200k 1/16W 1% 0603	VISHAY, CRCW06032003F
18	0	RSET1, RSET2, R2, R12	OPTIONAL	OPT
19	1	U1	IC., HOT SWAP CONTROLLER	LINEAR, LTC4217CFE
20	1	U2	IC., HOT SWAP CONTROLLER	LINEAR, LTC4217CDHC-12

SCHEMATIC DIAGRAM



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