


## DESCRIPTION

Demonstration circuit DC536 is a Hot Swap controller with multifunction current control featuring the LTC4211. The DC536 is configured to operate with up to 7A as populated by the factory. Optional component pads are provided for a higher power pass FET and sense resistor for operation up to 20A.

The DC536 permits evaluating the LTC4211 during turn-on and turn-off transients as well as during steady state conditions.

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

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**Table 1. Performance Summary ( $T_A = 25^\circ\text{C}$ )**

PARAMETER	CONDITION	VALUE
Supply Voltage	Rated operating limits	$2.5\text{V} \leq V_{CC} \leq 16.5\text{V}$
Under Voltage Lockout	Transition to operating mode	$2.13\text{V} \leq V_{CC(UVLO)} \leq 2.47\text{V}$
ON Pin Threshold Voltage, High		$1.23\text{V} \leq V_{CC(UVLO)} \leq 1.39\text{V}$
ON Pin Threshold Voltage, Low		$1.20\text{V} \leq V_{CC(UVLO)} \leq 1.26\text{V}$
Gate Pull-Up current	Charge Pump On, $V_{GATE} = 0.2\text{V}$	$7.5\mu\text{A} \leq I_{GATE} \leq 12.5\mu\text{A}$
Normal Gate Pull-Down Current	ON Pin Signal Low	$130\mu\text{A} \leq I_{GATE} \leq 270\mu\text{A}$
Fast Gate Pull-Down Current	• Latched and Circuit Breaker Tripped or in UVLO	50mA
Current Limit	Si4410 and $7\text{m}\Omega$ SENSE Resistor	$5.7\text{A} \leq I_{LIMIT} \leq 8.5\text{A}$
	FDB8030L and $2.5\text{m}\Omega$ SENSE Resistor	$16\text{A} \leq I_{LIMIT} \leq 24\text{A}$
Supply Voltage	Rated operating limits	$2.5\text{V} \leq V_{CC} \leq 16.5\text{V}$
Under Voltage Lockout		$2.13\text{V} \leq V_{CC(UVLO)} \leq 2.47\text{V}$
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Gate Pull-Up current	Charge Pump On, $V_{GATE} = 0.2\text{V}$	$7.5\mu\text{A} \leq I_{GATE} \leq 12.5\mu\text{A}$
Normal Gate Pull-Down Current	ON Pin Signal Low	$130\mu\text{A} \leq I_{GATE} \leq 270\mu\text{A}$

## OPERATING PRINCIPLES

The LTC4211 is a low voltage hot swap controller that has a 2.5V to 16.5V operating range and a 17V absolute maximum operating voltage for the Vcc pin. This demo circuit is populated for +5V operation, but it can easily be re-adjusted for any voltage between 2.5V to 16.5V by replacing R3 and R1 (top resistors in the feedback divider and the ON pin signal divider). There are two as-

sembly options for load current. The DC536 as supplied by the factory is populated with an Si4410 MOSFET in an SO-8 package and a  $7\text{m}\Omega$  current sense resistor providing a minimum 5A load current. The DC536 has provision for an FDB8030L MOSFET in the DD package which when used with a  $2.5\text{m}\Omega$  sense resistor provides a minimum 16A load current.

### QUICK START PROCEDURE

Demonstration circuit 536 is easy to set up to evaluate the performance of the LTC4211. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. The DC536 is factory setup to operate in a 5 volt system at current levels up to 5 amps. If the LTC4211 is to be evaluated at a different operating condition, follow 2-6 below, otherwise skip to 7.
2. If evaluating at a voltage other than 5V, R3 must be adjusted for proper RESET PIN response. Select  $R3 = V_{MIN} \cdot 15K / 1.223 - 15K$ , where  $V_{MIN}$  is the minimum output voltage expected for normal operation.
3. The ON pin operates as a precision comparator and can accurately provide an adjustable under voltage lockout. The DC536 is initially configured to turn on at  $4.15V_{MIN}$ . If 3.3V logic will drive this pin, R1 can be replaced with a short. If the ON pin will be used to provide under voltage lockout, then select R1 such that  $R1 = V_{UVLO} \cdot 10K / 1.39 - 10K$ , where  $V_{UVLO}$  is the minimum turn on voltage. Refer to the data sheet figure 3 for common configurations
4. If the DC536 will operate at other than 7Amps max, increase the value of  $R_{SENSE} = 0.99 \cdot I_{LOAD} / 40mV$  for a 1% tolerance current sense resistor.
5. If the DC536 will be operating above 7Amps, replace Q1 with a suitable DD package MOSFET such as the FDB8030L suitable for up to 20Amps. There is a DD package footprint on the back of the board.
6. The soft start and power good (RESET release) delay is factory set to 6.2ms. This delay can be adjusted by changing  $C_{TIMER}$  refer to the data sheet Table 1 for common values and the SYSTEM TIMING section for more detailed information.
7. After any necessary component changes have been made, connect a suitable load between VOUT and GND. This may be a passive resistive load or an active electronic load box.
8. Connect a power supply capable of supplying  $1.5 \cdot I_{LOAD}$  between the VIN and GND turrets. The minimum current capability of the supply must accommodate the tolerance of the circuit breaker threshold of  $\pm 20\%$ . With the  $7m\Omega$  factory installed sense resistor, the overload circuit breaker will trip at between 5.7A to 8.5Amp (7Amp nominal). Connect the ON/OFF turret to the VIN turret to enable power to the load. A function generator can be used to generate a single event and trigger a scope. The DC536 provides convenient turrets for observing the FAULT, RESET and VOUT signals.
9. The following experiments can be run. Turn on into a nominal load. Turn on into an overload. Turn on into a short circuit. Turn on into a nominal load and increase the load until the LTC4211 trips off. A digital storage scope provides a convenient means of observing the turn on and overload events. Observe the input or output current using a current probe. A current transformer can be used to observe turn on current transients if a current probe is not available.



# QUICK START GUIDE FOR DEMONSTRATION CIRCUIT 536

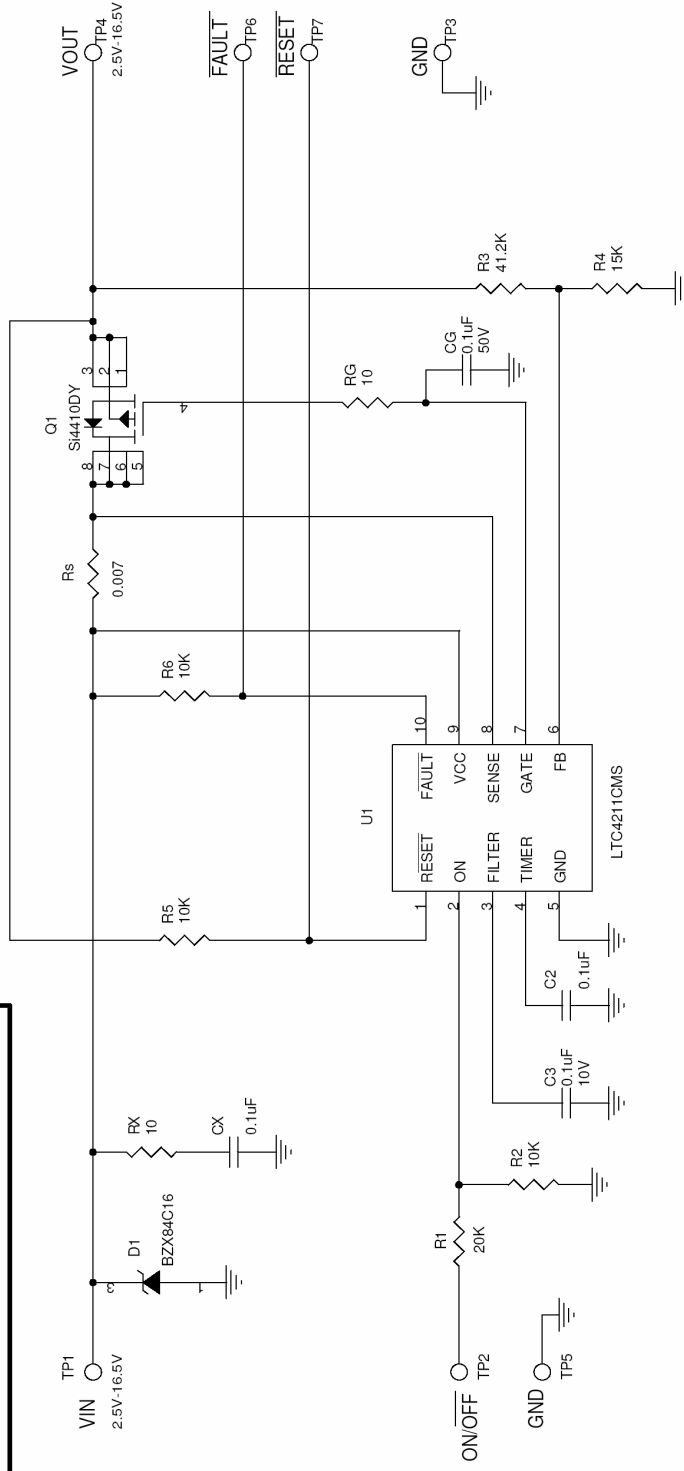
## HOT SWAP CONTROLLER WITH MULTIFUNCTION CURRENT CONTROL

This circuit is proprietary to Linear Technology and supplied for use with Linear Technology parts.

**Customer Notice:** Linear Technology has made a best effort to design a circuit that meets customer-supplied specifications; however, it remains the customer's 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 Applications Engineering for assistance.

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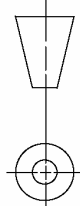
ECO		REV		DESCRIPTION		REVISION HISTORY	
	1		1	PROTO		DATE	APPROVED
						05-15-02	



VERSION	Q1	R5 (OHMS)	CURRENT (AMPS)
-A	Si4410DY	0.007	7A
-B	FDB8030L	0.0025	20A

CONTRACT NO.

UNLESS OTHERWISE SPECIFIED  
DIMENSIONS ARE IN INCHES  
TOLERANCE ON ANGLE . . . .  
2 PLACES . . . 3 PLACES . . . .  
INTERPRET DIM AND TOL  
PER ASME Y14.5M-1994  
THIRD ANGLE PROJECTION



DO NOT SCALE DRAWING

APPROVALS

DRAWN MEI

CHECKED

APPROVED

ENGINEER

DESIGNER

DATE 05/15/02

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LINEAR TECHNOLOGY

TITLE SCH, LTC4211CMS HOT SWAP MULTIFUNCTION  
CURRENT CONTROL

SIZE A CAGE CODE DWGNO DC536A

SCALE:NONE

FILENAME: 536A-1.DSN

WEDNESDAY, SEPTEMBER 15, 2004

SHEET 1

OF 1

REV 1

# QUICK START GUIDE FOR DEMONSTRATION CIRCUIT 536 HOT SWAP CONTROLLER WITH MULTIFUNCTION CURRENT CONTROL

Linear Technology Corporation  
LTC4211CMS

**Parts List**

DC536A-A Rev 1  
11/5/2004

Item	Qty	Ref	Desc	Part Number
1	1	CG	CAP, X7R 0.1uF 50V 10% 0603	TDK C1608X7R1H104K
	1	C3	CAP, X7R 0.1uF 10V 10% 0603	AVX 0603ZC104KAT
2	2	CX,C2	CAP, X7R 0.1uF 50V 20% 0805	AVX 08055C104MAT
3	1	D1	DIODE, ZENER 350mW	DIODES INC. BZX84C16
4	1	Q1	XSTR, Si4410DY N-CHANNEL 30V (D-S) MOSFET	SILICONIX Si4410DY
5	1	R3	RES, 41.2K OHMS 1% 1/10W 0603	AAC CR16-4122FM
6	2	RX,RG	RES, 10 OHM 1% 1/16W 0603	AAC CR16-10R0FM
7	1	Rs	RES, 0.007 OHM 1% 1W 2512	PANASONIC ERJM1WSF7M0U
8	1	R1	RES, 20K OHM 1% 1/16W 0603	AAC CR16-2002FM
9	3	R2,R5,R6	RES, 10K OHM 1% 1/16W 0603	AAC CR16-1002FM
10	1	R4	RES, 15K OHM 1% 1/16W 0603	AAC CR16-1502FM
11	7	TP1-TP7	TURRET	MILL-MAX 2501-2
12	1	U1	IC, LTC4211CMS HOT SWAP CONTROLLER	LINEAR TECH. LTC4211CMS

Linear Technology Corporation  
LTC4211CMS

**Parts List**

DC536A-B Rev 1  
11/5/2004

Item	Qty	Ref	Desc	Part Number
1	1	CG	CAP, X7R 0.1uF 50V 10% 0603	TDK C1608X7R1H104K
2	1	C3	CAP, X7R 0.1uF 10V 10% 0603	AVX 0603ZC104KAT
3	2	CX,C2	CAP, X7R 0.1uF 50V 20% 0805	AVX 08055C104MAT
4	1	D1	DIODE, ZENER 350mW	DIODES INC. BZX84C16
5	1	Q1	XSTR, FD8030L N-CHANNEL 30V (D-S) MOSFET	FAIRCHILD FDB8030L
6	1	R3	RES, 41.2K OHMS 1% 1/10W 0603	AAC CR16-4122FM
7	2	RX,RG	RES, 10 OHM 1% 1/16W 0603	AAC CR16-10R0FM
8	1	Rs	RES, 0.0025 OHM 1% 1W 2512	IRC CSS1-100-R0025-J
9	1	R1	RES, 20K OHM 1% 1/16W 0603	AAC CR16-2002FM
10	3	R2,R5,R6	RES, 10K OHM 1% 1/16W 0603	AAC CR16-1002FM
11	1	R4	RES, 15K OHM 1% 1/16W 0603	AAC CR16-1502FM
12	7	TP1-TP7	TURRET	MILL-MAX 2501-2
13	1	U1	IC, LTC4211CMS HOT SWAP CONTROLLER	LINEAR TECH. LTC4211CMS