ANALOG DEVICES

Four-String, White LED Driver for LCD Backlight Applications

Preliminary Technical Data

ADD5211

FEATURES

White LED driver based on an inductive boost controller
    Wide input voltage range: 4.5 V to 40 V
    Adaptive output voltage to minimize power dissipation
    Adjustable operating frequency: 200 kHz to 1.2 MHz
    Programmable UVLO
    Programmable soft start time for boost converter
    Programmable external MOSFET switching rising/falling time
Drives up to 4 LED current sinks with internal MOSFETs
    Brightness control with PWM input
    Adjustable LED current: 40 mA up to 200 mA
    Headroom control to maximize efficiency
    LED dimming frequency: up to 25 kHz
    1000:1 PWM dimming at 300 Hz
    Open drain fault indicator
    LED open and LED short fault protection
    Thermal shutdown
    Undervoltage lockout
    24-lead, 4 mm × 4 mm LFCSP

APPLICATIONS

LCD monitor and TV LED backlights
Industrial lighting

GENERAL DESCRIPTION

The ADD5211 is a 4 channel, white LED driver for backlight applications based on high efficiency, current mode, step-up converter technology. The boost controller drives an external MOSFET switch for step-up regulation from an input voltage of 4.5 V to 40 V and a pin adjustable operating frequency between 200 kHz and 1.2 MHz. An adjustable UVLO function is implemented to reduce input current during power-off.

The ADD5211 contains four regulated current sinks for uniform brightness intensity. Each current sinks can be driven from 40 mA up to 200 mA and the LED driving current is pin adjustable by an external resistor. The ADD5211 with an input PWM interface drives up to four parallel strings of multiple series connected LEDs with ±1.5% current matching between strings.

Additional features include fault indicator output LED short protection, LED open protection, boost output short protection, overvoltage protection, cycle-by-cycle current limit, and thermal shutdown for both the IC and LED array. The programmable soft start is implemented to reduce inrush current during startup.
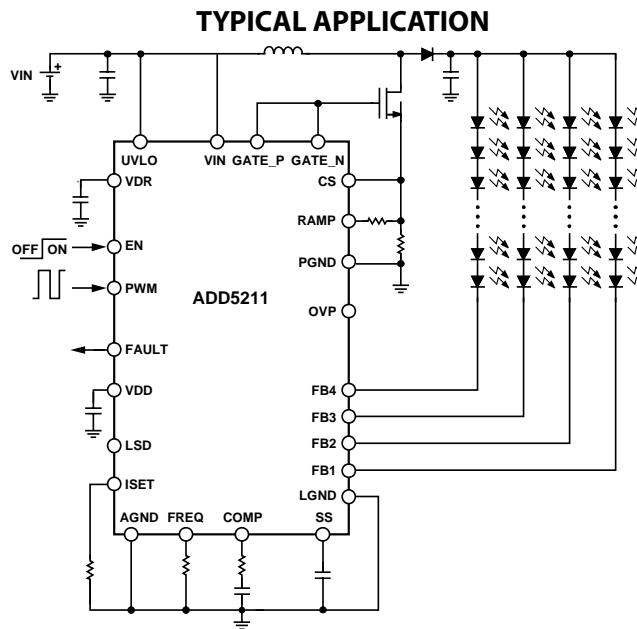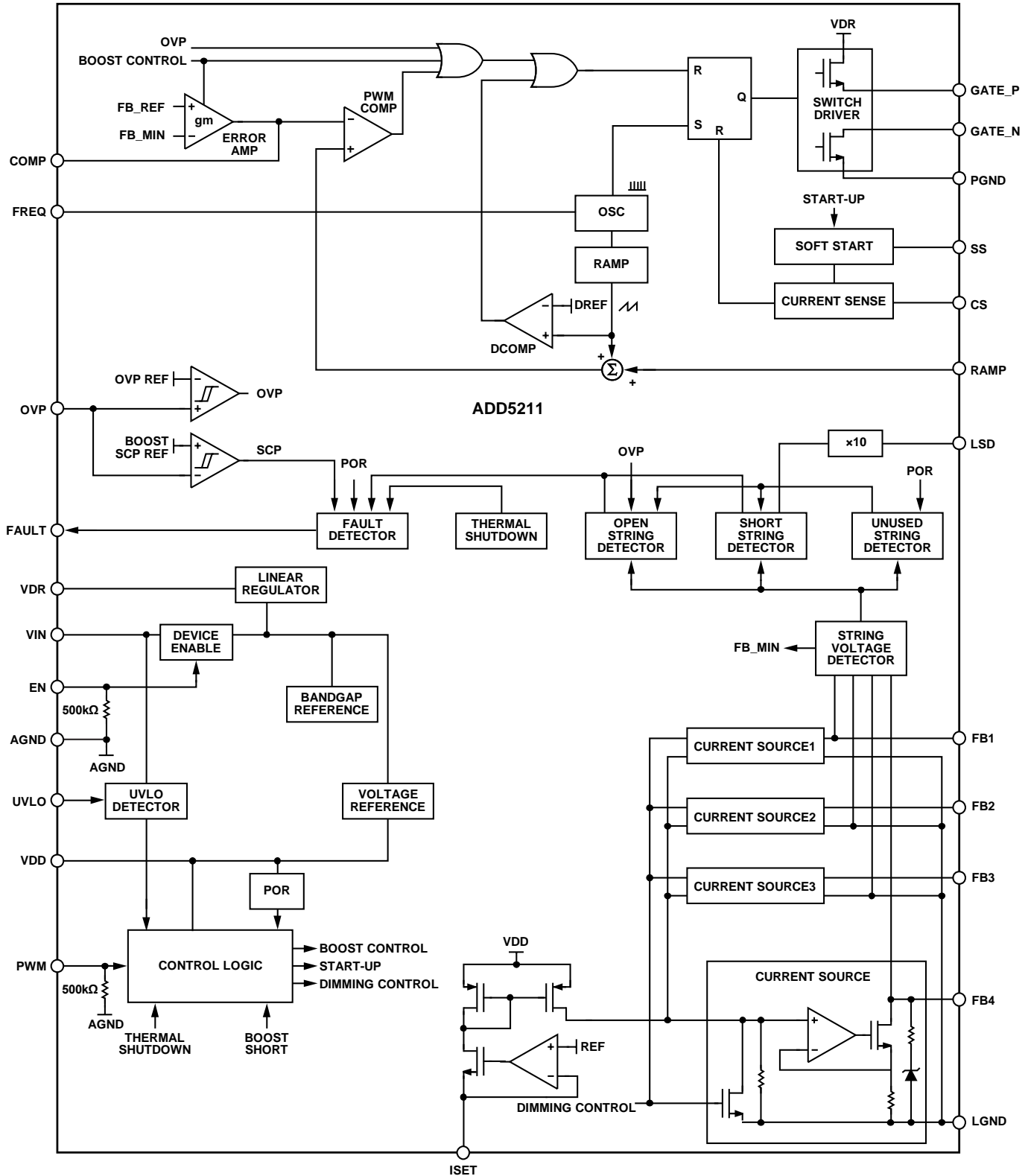
TYPICAL APPLICATION

Figure 1.

DETAILED FUNCTIONAL BLOCK DIAGRAM

Figure 2.

ABSOLUTE MAXIMUM RATINGS

T_A = 25°C, unless otherwise noted.

Table 1.

Parameter	Rating
VIN, UVLO	−0.3 V to +45 V
FB1, FB2, FB3, FB4	−0.3 V to +55 V
EN	−0.3 V to +20 V
PWM, FAULT	−0.3 V to +10 V
VDR, GATE_N, GATE_P	−0.3 V to +7 V
VDD, LSD , OVP, CS, RAMP, SS	−0.3 V to +3.7 V
FREQ, ISET, COMP	−0.3 V to +3.5 V
AGND, PGND, LGND	−0.3 V to +0.3 V
Maximum Junction Temperature (T_J max)	150°C
Operating Temperature Range (T_A)	−25°C to +85°C
Storage Temperature Range (T_S)	−65°C to +150°C
Reflow Peak Temperature (20 sec to 40 sec)	260°C

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

THERMAL RESISTANCE

θ_{JA} is specified for the worst-case conditions, that is, a device soldered in a circuit board for surface-mount packages.

Table 2. Thermal Resistance

Package Type	θ_{JA}	θ_{JC}	Unit
24-Lead LFCSP	40.5	3.8	°C/W

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.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS
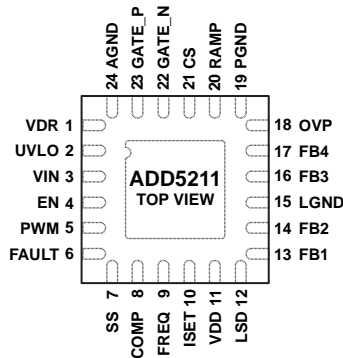
NOTES
1. CONNECT THE EXPOSED PADDLE TO GROUND.

Figure 3. Pin Configuration

Table 3. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	VDR	Switching MOSFET Gate Driver Supply Pin. Bypass VDR to AGND with a 1 μF bypass capacitor.
2	UVLO	Input Undervoltage Lockout. Set the start-up and shutdown input voltage level by connecting this pin to the input voltage through a voltage divide resistor.
3	VIN	Supply Input Pin. Bypass VIN to AGND with a 1 μF bypass capacitor.
4	EN	Shutdown Control Pin for PWM Input Operation Mode.
5	PWM	PWM Signal Input.
6	FAULT	Open Drain Fault Output.
7	SS	Soft Start Pin.
8	COMP	Compensation for the Boost Converter. Two capacitors and a resistor are connected in series between ground and this pin for stable operation.
9	FREQ	Frequency Select. A resistor from this pin to

Pin No.	Mnemonic	Description
		ground sets the boost switching frequency from 200 kHz to 1.2 MHz.
10	ISET	Full-Scale LED Current Set. A resistor from this pin to ground sets the LED current up to 200 mA.
11	VDD	Internal Linear Regulator Output. This regulator provides power to the ADD5211. Bypass VDD to AGND with a 1 μF bypass capacitor.
12	LSD	LED Short Voltage Level Setting Pin. To disable LED short protection, connect this pin to VDD.
13	FB1	Regulated Current Sink. Connect the bottom cathode of the LED string to this pin. If unused, connect FB1 to LGND.
14	FB2	Regulated Current Sink. Connect the bottom cathode of the LED string to this pin. If unused, connect FB2 to LGND.
15	LGND	LED Current Sink Ground.
16	FB3	Regulated Current Sink. Connect the bottom cathode of the LED string to this pin. If unused, connect FB3 to LGND.
17	FB4	Regulated Current Sink. Connect the bottom cathode of the LED string to this pin. If unused, connect FB4 to LGND.
18	OVP	Overvoltage Protection. The boost converter output is connected to this pin with voltage divide resistors.
19	PGND	Power Ground.
20	RAMP	Ramp Compensation Pin.
21	CS	Current Sense Input. Allows the current sensing to control the boost and to limit the switching current.
22	GATE_N	Switching MOSFET Gate Low Driving Pin.
23	GATE_P	Switching MOSFET Gate High Driving Pin.
24	AGND	Analog Ground.
	EP	Exposed Paddle. Connect the exposed paddle to ground.

TYPICAL APPLICATIONS CIRCUITS
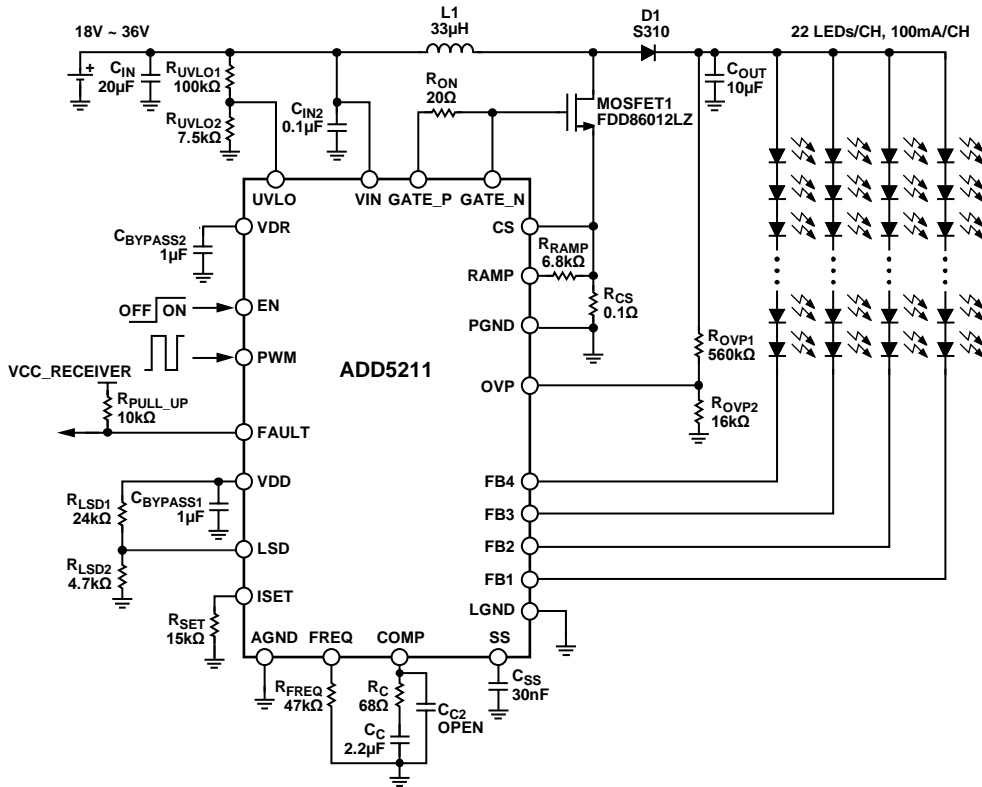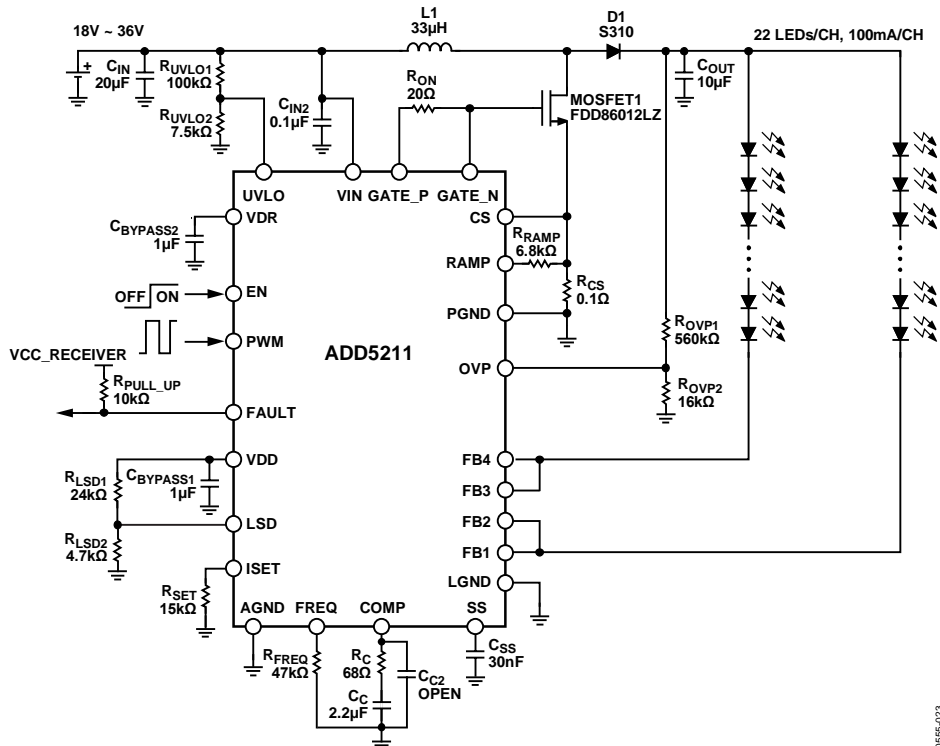

Figure 4. Typical Four-String Application Circuit

Figure 5. Typical Two-String Application Circuit

OUTLINE DIMENSIONS

COMPLIANT TO JEDEC STANDARDS MO-220-WGGD.

Figure 6. 24-Lead Lead Frame Chip Scale Package [LFCSP_WQ]
4 mm × 4 mm Body, Very Very Thin Quad
(CP-24-7)
Dimensions shown in millimeters

ORDERING GUIDE

Model[1]	Temperature Range	Package Description	Package Option
ADD5211ACPZ-R7	−25°C to +85°C	24-Lead LFCSP_WQ, 7" Tape and Reel	CP-24-7
ADD5211ACPZ-RL	−25°C to +85°C	24-Lead LFCSP_WQ, 13" Tape and Reel	CP-24-7

[1] Z = RoHS Compliant Part.

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