Four-String, White LED Driver for LCD Backlight Applications

Data Sheet

ADD5207

FEATURES

- White LED driver based on inductive boost converter
  - Integrated 40 V MOSFET with 1.5 A peak current limit
  - Input voltage range: 6 V to 21 V
  - Maximum output adjustable up to 36 V
  - 600 kHz to 1 MHz adjustable operating frequency
  - Typical 39 V fixed overvoltage protection (OVP)
  - Built-in soft start for boost converter
- Drives up to 4 LED current strings
  - LED current adjustable up to 25 mA for each channel
  - Headroom control to maximize efficiency
  - Fixed LED dimming frequency: 8 kHz
  - LED open fault protection
  - Brightness control with PWM input
- Dimming controls
  - 4-channel operation: 90 degree phase shift between channels
  - 3-channel operation: 120 degree phase shift between channels
- General
  - Thermal shutdown
  - Undervoltage lockout
  - 14-lead, 4 mm × 3 mm LFCSP

APPLICATIONS

Notebook PCs, UMPCs, and monitor displays

GENERAL DESCRIPTION

The ADD5207 is a white LED driver for backlight applications based on high efficiency, current mode, step-up converter technology. It is designed with a 0.15 Ω, 1.5 A internal switch and a pin-adjustable operating frequency between 600 kHz and 1 MHz.

The ADD5207 contains four regulated current sources for uniform LED brightness. Each current source can drive up to 25 mA and the LED-driving current is pin adjustable by an external resistor. The ADD5207 drives up to four parallel strings of multiple series-connected LEDs with a ±1.5% current matching between strings.

The ADD5207 provides phase shift PWM brightness control methods. LED dimming control is achieved through the PWM input. The device includes an 8 kHz LED-dimming oscillator for driving each current source. The ADD5207 operates over an input voltage range of 6 V to 21 V, but the device can function with a voltage as low as 5.6 V.

The ADD5207 also has multiple safety protection features to prevent damage during fault conditions. If any LED is open, the device automatically disables the faulty current source. The internal soft start circuit prevents a high inrush current during startup. Thermal shutdown protection prevents thermal damage.

The ADD5207 is available in a low profile, thermally enhanced, 4 mm × 3 mm × 0.75 mm, 14-lead, RoHS-compliant lead frame chip scale package (LFCSP) and is specified over the industrial temperature range of −25°C to +85°C.

TYPICAL APPLICATION CIRCUIT

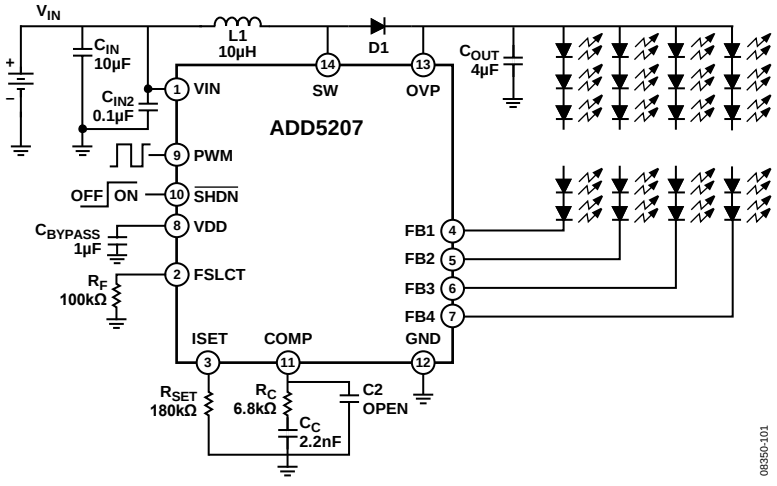


Figure 1.

Rev. A

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REVISION HISTORY

2/12—Rev. Sp0 to Rev. A

Replaced Block Diagram with Typical Application Circuit 1
Changes to Features Section and General Description Section . 1
Changes to Current Mode, Step-Up Switching Regulator Operation Section, Boost Converter Switching Frequency Section, PWM Dimming Mode Section, Phase Shift PWM Dimming Section, and Safety Features Section 11
Changes to Overvoltage Protection (OVP) Section 11
Changes to Open-Loop Protection (OLP) Section, Undervoltage Lockout (UVLO) Section, and Thermal Protection Section 12
Changes to Layout Guidelines Section 13

7/09—Revision Sp0: Initial Version

FUNCTIONAL BLOCK DIAGRAM

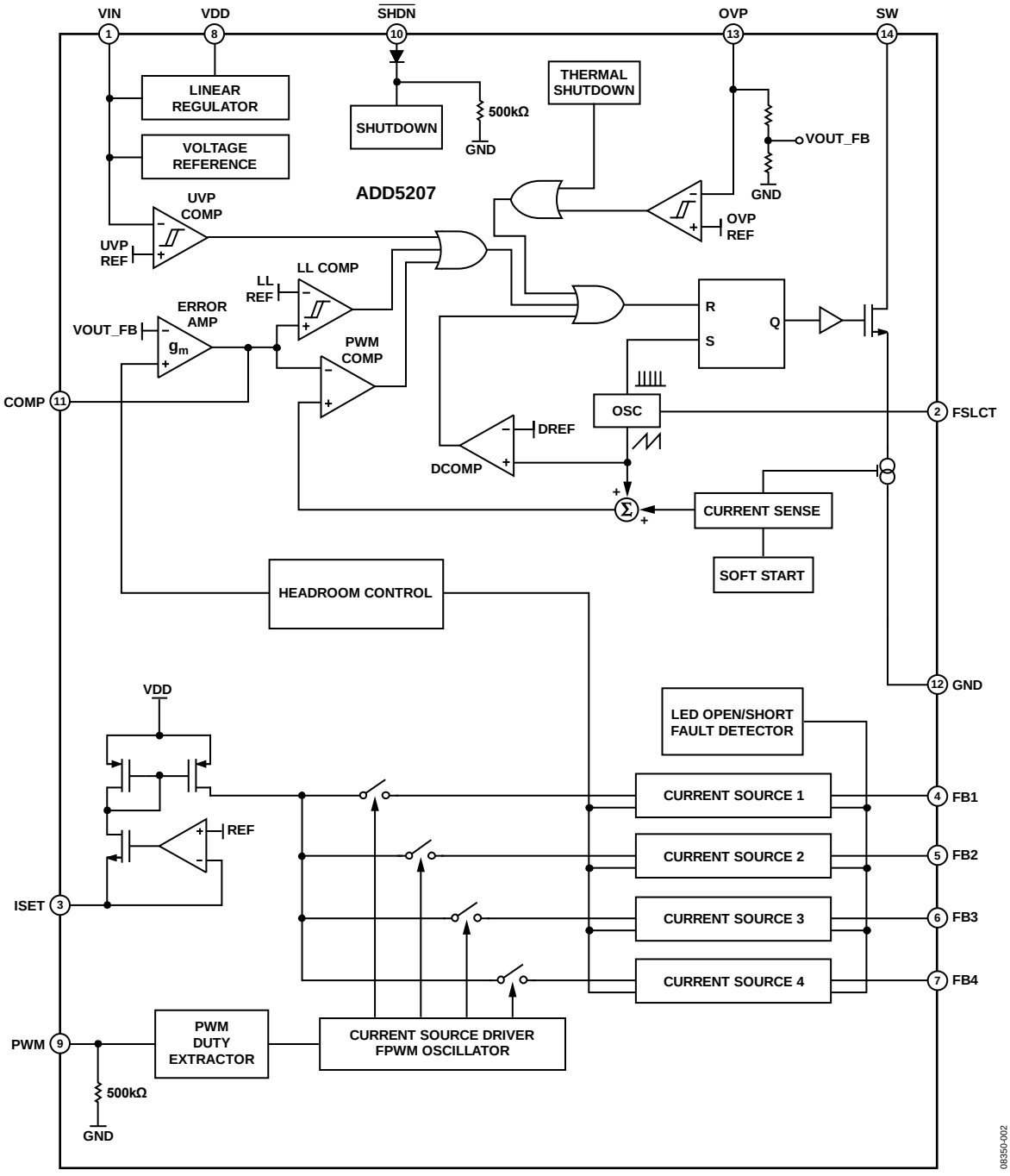


Figure 2. Functional Block Diagram

SPECIFICATIONS

STEP-UP SWITCHING REGULATOR SPECIFICATIONS

V_{IN} = 12 V, $\overline{SHDN}$ = high, T_A = −25°C to +85°C, unless otherwise noted. Typical values are at T_A = +25°C.

Table 1.

Parameter	Symbol	Test Conditions/Comments	Min	Typ	Max	Unit
SUPPLY						
Input Voltage Range	V_{IN}		6		21	V
BOOST OUTPUT						
Output Voltage	V_{OUT}				36	V
SWITCH						
On Resistance	$R_{DS(ON)}$	V_{IN} = 12 V, I_{SW} = 100 mA		150	300	mΩ
Leakage Current	I_{LKG}				1	µA
Peak Current Limit	I_{CL}	Duty cycle (D) = D_{MAX}	1.5			A
OSCILLATOR						
Switching Frequency	f_{SW}	R_F = 97 kΩ	800	1000	1200	kHz
Maximum Duty Cycle	D_{MAX}	R_F = 97 kΩ	84	90		%
SOFT START						
Soft Start Time	t_{SS}			1.1		ms
OVERVOLTAGE PROTECTION						
Overvoltage Rising Threshold on OVP Pin	V_{OVPR}		36.5	39	40	V
Overvoltage Hysteresis on OVP Pin	V_{OVP_HYS}		0.1	0.7	1.4	V

LED CURRENT REGULATION SPECIFICATIONS

V_{IN} = 12 V, $\overline{SHDN}$ = high, T_A = −25°C to +85°C, unless otherwise noted. Typical values are at T_A = +25°C.

Table 2.

Parameter	Symbol	Test Conditions/Comments	Min	Typ	Max	Unit
CURRENT SOURCE						
ISET Pin Voltage	V_{SET}	6 V ≤ V_{IN} ≤ 21 V	1.14	1.18	1.22	V
Adjustable LED Current[1]	I_{LED}		0		25	mA
Constant Current Sink of 20 mA[2]	I_{LED20}	R_{SET} = 180 kΩ	19.4	20	20.6	mA
Minimum Headroom Voltage[2]	V_{HR20}	R_{SET} = 180 kΩ		0.66	0.9	V
Current Matching Between Strings[2]		R_{SET} = 180 kΩ	−1.5		+1.5	%
LED Current Accuracy[2]		R_{SET} = 180 kΩ	−3		+3	%
Current Source Leakage Current					1	µA
FPWM GENERATOR						
Dimming Frequency	f_{PWM}		6.8	8.0	9.2	kHz
LED FAULT DETECTION						
Open Fault Delay[1]	$t_{D_OPENFAULT}$				6.5	µs

[1] This electrical specification is guaranteed by design.
[2] Tested at T_A = +25°C.

GENERAL SPECIFICATIONS

V_{IN} = 12 V, $\overline{SHDN}$ = high, T_A = −25°C to +85°C, unless otherwise noted. Typical values are at T_A = +25°C.

Table 3.

Parameter	Symbol	Test Conditions/Comments	Min	Typ	Max	Unit
SUPPLY						
Input Voltage Range	V_{IN}		6		21	V
Quiescent Current	I_Q	6 V ≤ V_{IN} ≤ 21 V, $\overline{SHDN}$ = high		3.5	7	mA
Shutdown Supply Current	I_{SD}	6 V ≤ V_{IN} ≤ 21 V, $\overline{SHDN}$ = low			2	µA
VDD REGULATOR						
VDD Regulated Output	V_{VDD_REG}	6 V ≤ V_{IN} ≤ 21 V	3.1	3.3	3.5	V
PWM INPUT						
PWM Voltage High	V_{PWM_HIGH}		2.0		5.5	V
PWM Voltage Low	V_{PWM_LOW}				0.8	V
PWM Input Range			100		10,000	Hz
THERMAL SHUTDOWN						
Thermal Shutdown Threshold[1]	T_{SD}			160		°C
Thermal Shutdown Hysteresis[1]	T_{SDHYS}			30		°C
UVLO						
V_{IN} Falling Threshold	V_{UVLOF}	V_{IN} falling	4	4.2		V
V_{IN} Rising Threshold	V_{UVLOR}	V_{IN} rising		5.0	5.6	V
$\overline{SHDN}$ CONTROL						
Input Voltage High	V_{IH}		2.5		5.5	V
Input Voltage Low	V_{IL}				0.5	V
$\overline{SHDN}$ Pin Input Current	$I_{\overline{SHDN}}$	$\overline{SHDN}$ = 3.3 V		6		µA

[1] This electrical specification is guaranteed by design.

ABSOLUTE MAXIMUM RATINGS

T_A = 25°C, unless otherwise noted.

Table 4.

Parameter	Rating
VIN	−0.3 V to +23 V
SW	−0.3 V to +40 V
$\overline{\text{SHDN}}$, PWM	−0.3 V to +6 V
ISET, FSLCT, COMP	−0.3 V to +3.5 V
VDD	−0.3 V to +3.7 V
FB1, FB2, FB3, FB4	−0.3 V to +40 V
OVP	−0.3 V to +40 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 5. Thermal Resistance

Package Type	θ_{JA}	θ_{JC}	Unit
14-Lead LFCSP	33.24	2.42	°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

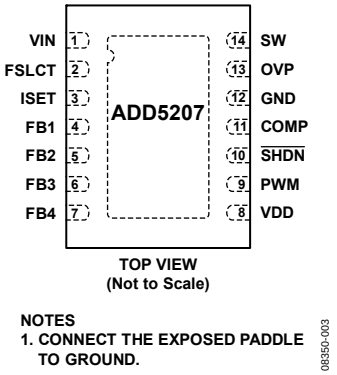


Figure 3. Pin Configuration

Table 6. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	VIN	Supply Input. Must be locally bypassed with a capacitor to ground.
2	FSLCT	Frequency Select. A resistor from this pin to ground sets the boost switching frequency from 600 kHz to 1 MHz.
3	ISET	Full-Scale LED Current Set. A resistor from this pin to ground sets the LED current up to 25 mA.
4	FB1	Regulated Current Sink. Connect the bottom cathode of the LED string to this pin.
5	FB2	Regulated Current Sink. Connect the bottom cathode of the LED string to this pin.
6	FB3	Regulated Current Sink. Connect the bottom cathode of the LED string to this pin.
7	FB4	Regulated Current Sink. Connect the bottom cathode of the LED string to this pin. If unused, connect FB4 to GND.
8	VDD	Internal Linear Regulator Output. This regulator provides power to the ADD5207.
9	PWM	PWM Signal Input.
10	$\overline{\text{SHDN}}$	Shutdown Control for PWM Input Operation Mode. Active low.
11	COMP	Compensation for the Boost Converter. Two capacitors and a resistor are connected in series between ground and this pin for stable operation.
12	GND	Ground.
13	OVP	Overvoltage Protection. The boost converter output is connected to this pin directly.
14	SW	Drain Connection of the Internal Power FET.
	EP	Exposed Paddle. Connect the exposed paddle to ground.

TYPICAL PERFORMANCE CHARACTERISTICS

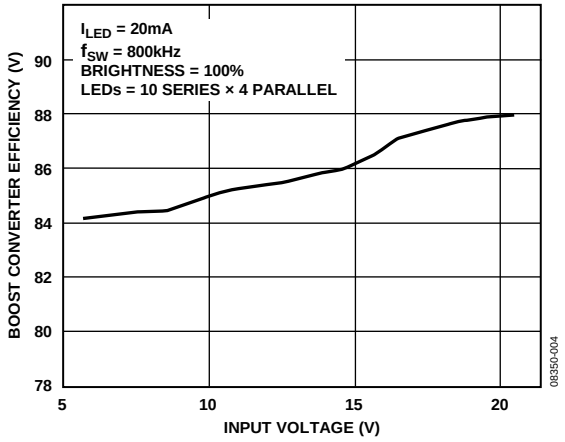


Figure 4. Boost Converter Efficiency vs. Input Voltage

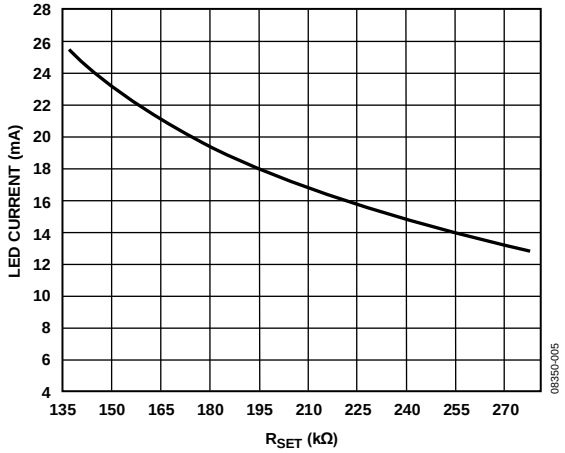


Figure 5. LED Current vs. R_{SET}

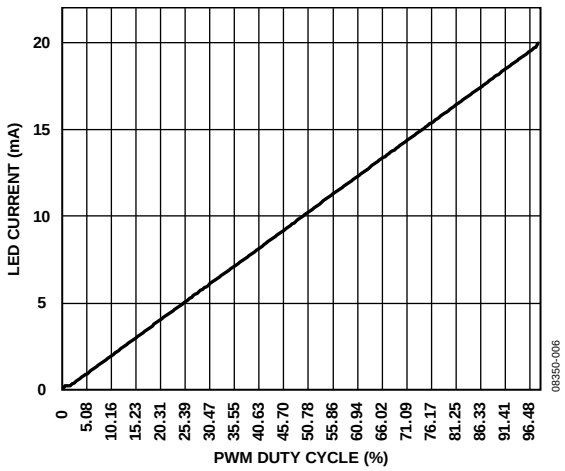


Figure 6. LED Current vs. PWM Input Duty Cycle

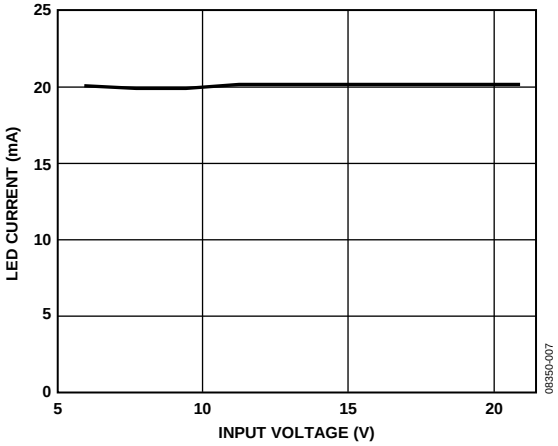


Figure 7. LED Current vs. Input Voltage (I_{LED} = 20 mA)

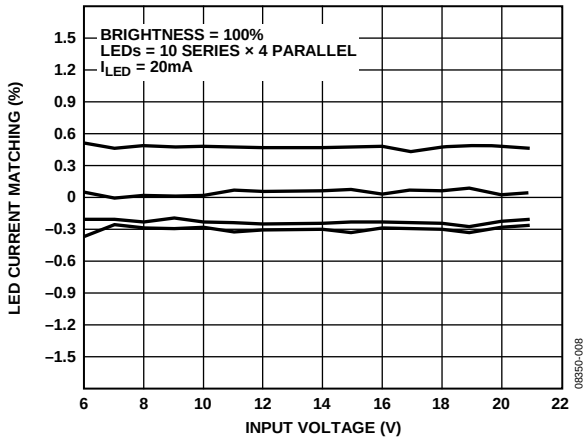


Figure 8. LED Current Matching vs. Input Voltage

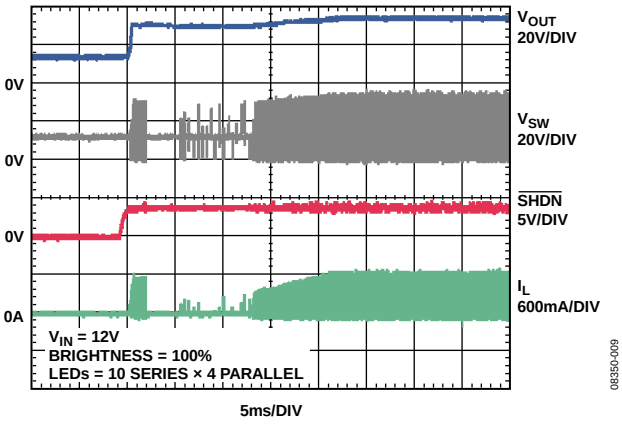


Figure 9. Start-Up Waveforms (Brightness = 100%)

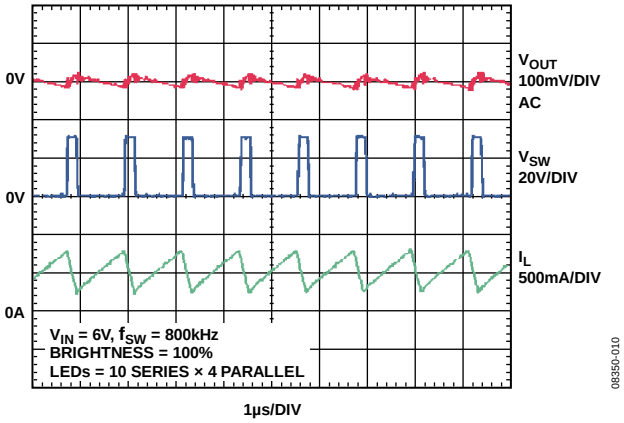


Figure 10. Switching Waveforms (V_{IN} = 6 V)

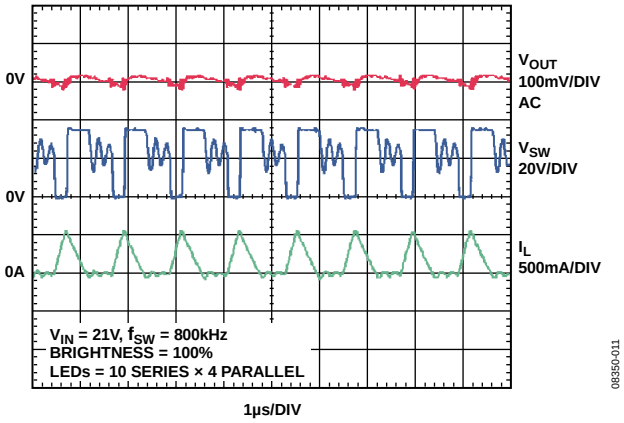


Figure 11. Switching Waveforms (V_{IN} = 21 V)

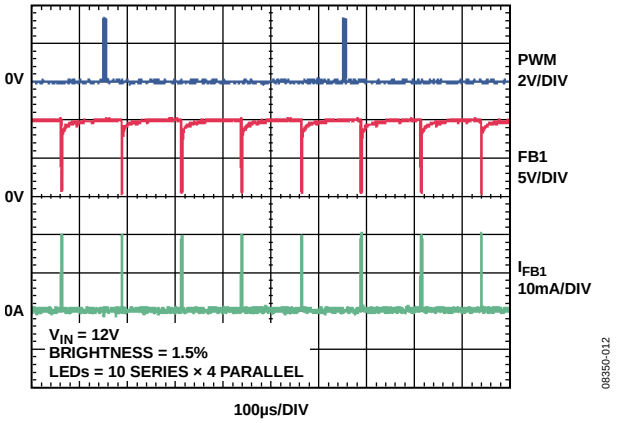


Figure 12. LED Current Waveforms (Brightness = 1.5%)

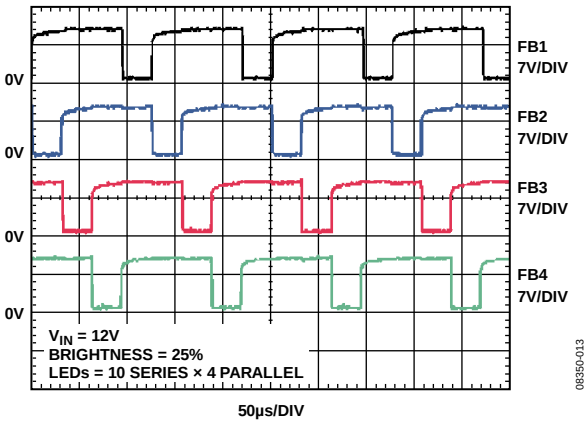


Figure 13. LED FBx Waveforms (Brightness = 25%)

THEORY OF OPERATION

CURRENT MODE, STEP-UP SWITCHING REGULATOR OPERATION

The ADD5207 uses a current mode PWM boost regulator to generate the minimum voltage needed to drive the LED string at the programmed LED current. The current mode regulation system allows a fast transient response while maintaining a stable output voltage. By selecting the proper resistor-capacitor network from COMP to GND, the regulator response is optimized for a wide range of input voltages, output voltages, and load conditions. The ADD5207 can provide a 36 V maximum output voltage and drive up to 10 LEDs (3.4 V/25 mA type of LEDs) for each channel.

INTERNAL 3.3 V REGULATOR

The ADD5207 contains a 3.3 V linear regulator that is used for biasing internal circuitry. The internal regulator requires a 1 µF bypass capacitor. Place this bypass capacitor between Pin VDD (Pin 8) and GND, as close as possible to Pin VDD.

BOOST CONVERTER SWITCHING FREQUENCY

The ADD5207 boost converter switching frequency is user adjustable, between 600 kHz to 1 MHz, by using an external resistor, R_F. A frequency of 600 kHz is recommended to optimize the regulator for high efficiency, and a frequency of 1 MHz is recommended to minimize the size of external components.

See Figure 14 for considerations when selecting a switching frequency and an adjustment resistor (R_F).

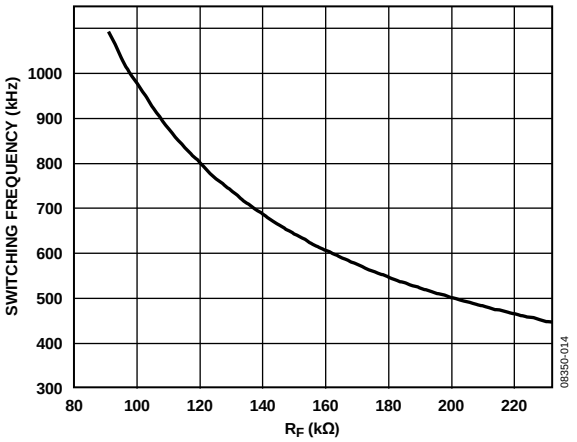


Figure 14. Switching Frequency vs. R_F

DIMMING FREQUENCY (f_{PWM})

The ADD5207 contains an internal oscillator to generate the PWM dimming signal for LED brightness control. The LED dimming frequency (f_{PWM}) is fixed at 8 kHz internally.

CURRENT SOURCE

The ADD5207 contains four current sources to provide accurate current sinking for each LED string. String-to-string tolerance is kept within ±1.5% at 20 mA. Each LED string current is adjusted up to 25 mA using an external resistor.

The ADD5207 contains an LED open fault protection circuit for each channel. If the headroom voltage of the current source remains below 150 mV while the boost converter output reaches the OVP level, the ADD5207 recognizes that the current source has an open-load fault for the current source, and the current source is disabled.

If an application requires three LED strings, each LED string should be connected using FB1 to FB3. The unused FB4 pin should be tied to GND.

The ADD5207 contains hysteresis to prevent the LED current change that is caused by a ±0.195% jitter of the PWM input.

Programming the LED Current

As shown in the Figure 2, the ADD5207 has an LED current set pin (ISET). A resistor (R_{SET}) from this pin to ground adjusts the LED current up to 25 mA. LED current level can be set with following equation:

$$I_{LED} = \frac{3600}{R_{SET}}(A)$$

PWM DIMMING MODE

The ADD5207 supports 8-bit resolution to control brightness. However, each current source has a minimum on time requirement for LED current regulation such that the dimming is in the range of 1.5% to 100%. Accordingly, even when the PWM input duty cycle is more than 0% and less than 1.5%, the LED duty cycle is held at 1.5%.

Phase Shift PWM Dimming

There is a phase delay between each current source channel that is programmed by the number of current sources in operation. If the application requires four separate LED strings, each string has a 90 degree phase delay between channels. If three LED strings are connected at the FB1 to FB3 pins (FB4 = GND), each string has a 120 degree phase delay.

SAFETY FEATURES

The ADD5207 contains several safety features to provide stable and reliable operation.

Soft Start

The ADD5207 contains an internal soft start function to reduce inrush current at startup. The soft start time is typically 1.1 ms.

Overvoltage Protection (OVP)

The ADD5207 contains OVP circuits to prevent boost converter damage if the output voltage becomes excessive for any reason. To keep a safe output level, the integrated OVP circuit monitors

the output voltage. When the OVP pin voltage reaches the OVP rising threshold, the boost converter stops switching, which causes the output voltage to drop. When the OVP pin voltage drops below the OVP falling threshold, the boot converter begins switching again, causing the output to rise. There is about 0.8 V hysteresis between the rising and falling thresholds. The OVP level is fixed at 39 V (typical).

Open-Load Protection (OLP)

The ADD5207 contains a headroom control circuit to minimize power loss at each current source. Therefore, the minimum feedback voltage is achieved by regulating the output voltage of the boost converter. If any LED string is open circuit during normal operation, the current source headroom voltage (V_{HR}) is pulled to GND. In this condition, OLP is activated if V_{HR} is less than 150 mV until the boost converter output voltage rises up to the OVP level.

Undervoltage Lockout (UVLO)

An undervoltage lockout circuit is included with built-in hysteresis. The ADD5207 turns on when V_{IN} rises above 5.0 V (typical) and shuts down when V_{IN} falls below 4.2 V (typical).

Thermal Protection

Thermal overload protection prevents excessive power dissipation from overheating and damaging the ADD5207. When the junction temperature (T_J) exceeds 160°C, a thermal sensor immediately activates the fault protection, which shuts down the device and allows it to cool. The device self-starts when the junction temperature (T_J) of the die falls below 130°C.

EXTERNAL COMPONENT SELECTION GUIDE

Inductor Selection

The inductor is an integral part of the step-up converter. It stores energy during the switch's on time and transfers that energy to the output through the output diode during the switch's off time. An inductor in the range of 4.7 µH to 22 µH is recommended. In general, lower inductance values result in higher saturation current and lower series resistance for a given physical size. However, lower inductance results in higher peak current, which can lead to reduced efficiency and greater input and/or output ripple and noise. Peak-to-peak inductor ripple current at close to 30% of the maximum dc input current typically yields an optimal compromise.

The input (V_{IN}) and output (V_{OUT}) voltages determine the switch duty cycle (D), which, in turn, is used to determine the inductor ripple current.

$$D = \frac{V_{OUT} - V_{IN}}{V_{OUT}}$$

Use the duty cycle and switching frequency (f_{SW}) to determine the on time.

$$t_{ON} = \frac{D}{f_{SW}}$$

The inductor ripple current (ΔI_L) in a steady state is:

$$\Delta I_L = \frac{V_{IN} \times t_{ON}}{L}$$

Solve for the inductance value (L):

$$L = \frac{V_{IN} \times t_{ON}}{\Delta I_L}$$

Make sure that the peak inductor current (that is, the maximum input current plus half of the inductor ripple current) is less than the rated saturation current of the inductor. In addition, ensure that the maximum rated rms current of the inductor is greater than the maximum dc input current to the regulator.

For duty cycles greater than 50% that occur with input voltages greater than half the output voltage, slope compensation is required to maintain stability of the current mode regulator. The inherent open-loop stability causes subharmonic instability when the duty ratio is greater than 50%. To avoid subharmonic instability, the slope of the inductor current should be less than half of the compensation slope.

Inductor manufacturers include: Coilcraft, Inc., Sumida Corporation, and Toko.

Input and Output Capacitor Selection

The ADD5207 requires input and output bypass capacitors to supply transient currents while maintaining a constant input and output voltage. Use a low effective series resistance (ESR) 10 µF or greater capacitor for the input capacitor to prevent noise at the ADD5207 input. Place the input between VIN and GND, as close as possible to the ADD5207. Ceramic capacitors are preferred because of their low ESR characteristics. Alternatively, use a high value, medium ESR capacitor in parallel with a 0.1 µF low ESR capacitor as close as possible to the ADD5207.

The output capacitor maintains the output voltage and supplies current to the load while the ADD5207 switch is on. The value and characteristics of the output capacitor greatly affect the output voltage ripple and stability of the regulator. Use a low ESR output capacitor; ceramic dielectric capacitors are preferred.

For very low ESR capacitors, such as ceramic capacitors, the ripple current due to the capacitance is calculated as follows. Because the capacitor discharges during the on time (t_{ON}), the charge removed from the capacitor (Q_C) is the load current multiplied by the on time. Therefore, the output voltage ripple (ΔV_{OUT}) is

$$\Delta V_{OUT} = \frac{Q_C}{C_{OUT}} = \frac{I_L \times t_{ON}}{C_{OUT}}$$

where:
C_{OUT} is the output capacitance.
I_L is the average inductor current.

Using the duty cycle and switching frequency (f_{SW}), users can determine the on time with the following equation:

$$t_{ON} = \frac{D}{f_{SW}}$$

The input (V_{IN}) and output (V_{OUT}) voltages determine the switch duty cycle (D) with the following equation:

$$D = \frac{V_{OUT} - V_{IN}}{V_{OUT}}$$

Choose the output capacitor based on the following equation:

$$C_{OUT} \geq \frac{I_L \times (V_{OUT} - V_{IN})}{f_{SW} \times V_{OUT} \times \Delta V_{OUT}}$$

Capacitor manufacturers include: Murata Manufacturing Co., Ltd., AVX, Sanyo, and Taiyo Yuden Co., Ltd.

Diode Selection

The output diode conducts the inductor current to the output capacitor and loads while the switch is off. For high efficiency, minimize the forward voltage drop of the diode. Schottky diodes are recommended. However, for high voltage, high temperature applications, where the Schottky diode reverse leakage current becomes significant and degrades efficiency, use an ultrafast junction diode. The output diode for a boost regulator must be chosen depending on the output voltage and the output current. The diode must be rated for a reverse voltage equal to or greater than the output voltage used. The average current rating must be greater than the maximum load current expected, and the peak current rating must be greater than the peak inductor current. Using Schottky diodes with lower forward voltage drop decreases power dissipation and increases efficiency. The diode must be rated to handle the average output load current. Many diode manufacturers derate the current capability of the diode as a function of the duty cycle. Verify that the output diode is rated to handle the average output load current with the minimum duty cycle.

The minimum duty cycle of the ADD5207 is:

$$D_{MIN} = \frac{V_{OUT} - V_{IN_MAX}}{V_{OUT}}$$

where V_{IN_MAX} is the maximum input voltage.

For example, D_{MIN} is 0.5 when V_{OUT} is 30 V and V_{IN_MAX} is 15 V.

Schottky diode manufacturers include ON Semiconductor, Diodes Incorporated, Central Semiconductor Corp., and Sanyo.

Loop Compensation

The external inductor, output capacitor, and the compensation resistor and capacitor determine the loop stability. The inductor and output capacitor are chosen based on performance, size, and cost. The compensation resistor (R_C) and compensation capacitor (C_C) at COMP are selected to optimize control loop stability. For typical LED application of the ADD5207, a 6.8 kΩ compensation resistor in series with a 2.2 nF compensation capacitor at COMP is adequate.

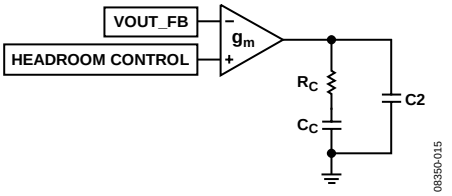


Figure 15. Compensation Components

A step-up converter produces an undesirable right-half plane zero in the regulation feedback loop. Capacitor C2 is chosen to cancel the zero introduced by output capacitance ESR. Solving for C2,

$$C2 = \frac{ESR \times C_{OUT}}{R_C}$$

For low ESR output capacitance, such as with a ceramic capacitor, C2 is optional.

LAYOUT GUIDELINES

When designing a high frequency, switching, regulated power supply, layout is very important. Using a good layout can solve many problems associated with these types of supplies. The main problems are loss of regulation at high output current and/or large input-to-output voltage differentials, excessive noise on the output and switch waveforms, and instability. Using the following guidelines helps minimize these problems.

Make all power (high current) traces as short, direct, and thick as possible. It is good practice on a standard printed circuit board (PCB) to make the traces an absolute minimum of 15 mil (0.381 mm) per ampere. The inductor, output capacitors, and output diode should be as close to each other as possible. This helps reduce EMI radiated by the power traces that carry high switching currents. Close proximity of the components also reduces lead inductance and resistance, which in turn reduce noise spikes, ringing, and resistive losses that produce voltage errors.

The grounds of the IC, input capacitors, output capacitors, and output diode (if applicable), should be connected close together, and directly to a ground plane. It is also a good idea to have a ground plane on both sides of the PCB. This reduces noise by reducing ground loop errors and by absorbing more of the EMI radiated by the inductor.

For multilayer boards of more than two layers, a ground plane can be used to separate the power plane (power traces and components) and the signal plane (feedback, compensation, and components) for improved performance. On multilayer boards, the use of vias is required to connect traces and different planes. If a trace needs to conduct a significant amount of current from one plane to the other, it is good practice to use one standard via per 200 mA of current. Arrange the components so that the switching current loops curl in the same direction.

Due to how switching regulators operate, there are two power states: one state when the switch is on, and one when the switch is off. During each state, there is a current loop made by the power components currently conducting. Place the power components so that the current loop is conducting in the same direction during each of the two states. This prevents magnetic field reversal caused by the traces between the two half cycles and reduces radiated EMI.

Layout Procedure

To achieve high efficiency, good regulation, and stability, a good PCB layout is required. It is recommended that the reference board layout be followed as closely as possible because it is already optimized for high efficiency and low noise.

Use the following general guidelines when designing PCBs:

- Keep C_{IN} close to the V_{IN} and GND leads of the ADD5207.
- Keep the high current path from C_{IN} (through L1) to the SW and GND leads as short as possible.
- Keep the high current path from C_{IN} (through L1), D1, and C_{OUT} as short as possible.
- Keep high current traces as short and as wide as possible.
- Keep nodes connected to SW away from sensitive traces, such as COMP, to prevent coupling of the traces. If such traces must be run near each other, place a ground trace between the two as a shield.
- Place the compensation components as close as possible to the COMP pin.
- Place the LED current setting resistors as close as possible to each pin to prevent noise pickup.
- Avoid routing noise-sensitive traces near high current traces and components, especially the LED current setting node (I_{SET}).
- Use a thermal pad size that is the same dimension as the exposed pad on the bottom of the package.

Heat Sinking

When using a surface-mount power IC or external power switches, the PCB can often be used as the heat sink. This is done by using the copper area of the PCB to transfer heat from the device. Users should maximize this area to optimize thermal performance.

TYPICAL APPLICATION CIRCUITS

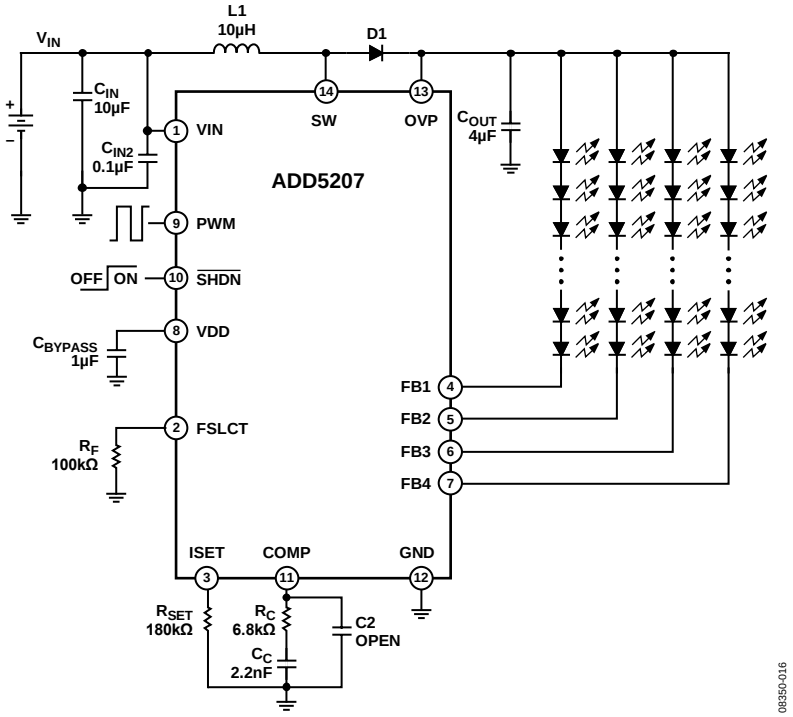


Figure 16. Typical Four-String Application Circuit

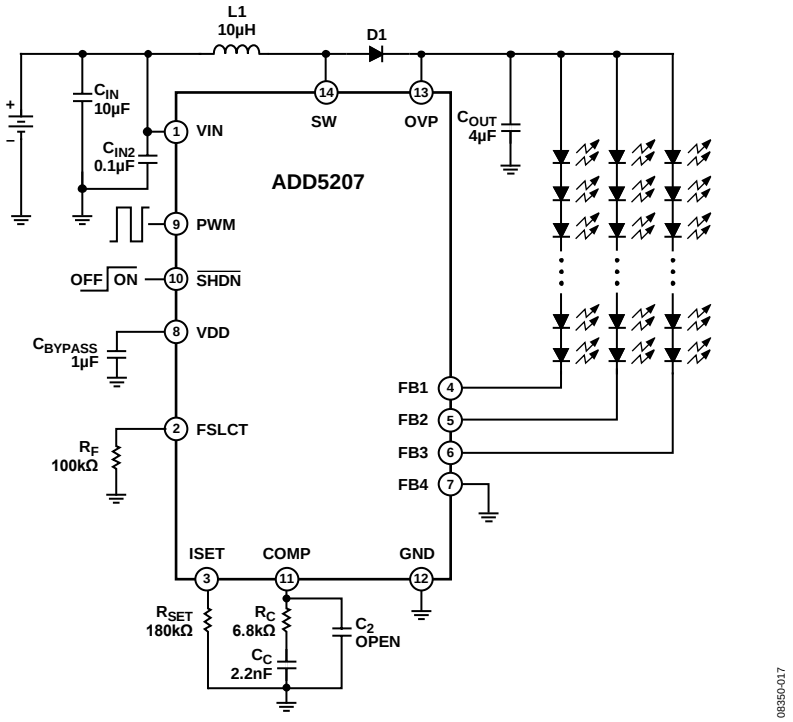


Figure 17. Typical Three-String Application Circuit

OUTLINE DIMENSIONS

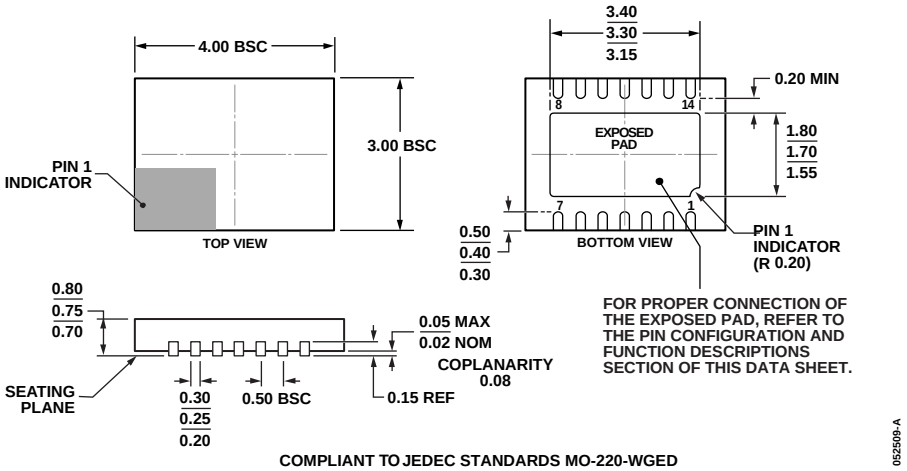


Figure 18. 14-Lead Lead Frame Chip Scale Package [LFCSP_WD]
4 mm × 3 mm Body, Very Very Thin Dual
(CP-14-1)
Dimensions shown in millimeters

ORDERING GUIDE

Model[1]	Temperature Range	Package Description	Package Option
ADD5207ACPZ-RL	−25°C to +85°C	14-Lead LFCSP_WD	CP-14-1

[1] Z = RoHS Compliant Part.

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