

# 1A High Power LED Driver with 6-36V Input

## General Description

The GGD42522 is a step-down PWM control LED driver with a built-in power MOSFET. It achieves 1A continuous output current in 6~36V input voltage range. It provides thermal shutdown circuit, current limit circuit.

The GGD42522 adopts current mode control which provides fast transient response, excellent constant current characteristic and simple loop stabilization design. It has high efficiency up to more than 96%. When the input/output voltage changed, the output current change rate is within  $\pm 1\%$ .



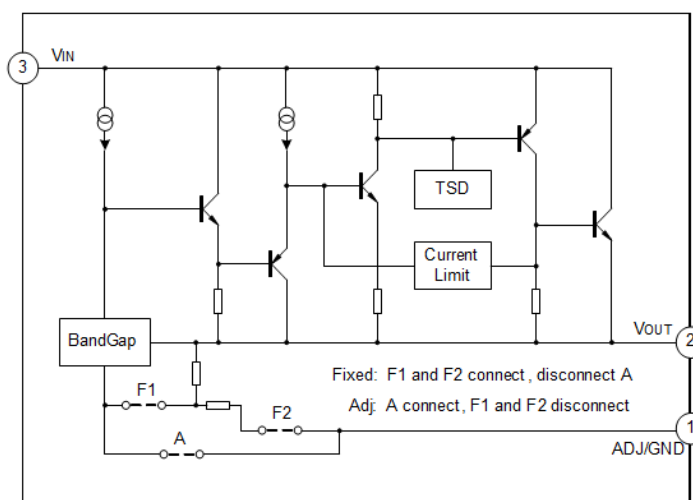
## Features

- 6-36V input voltage range
- Maximum 1A output current
- built-in power MOSFET: 0.40Ω
- Integrate Jitter function
- 280kHz fixed frequency
- Output current accuracy between ICs:  $\pm 1.5\%$
- High efficiency up to 96%
- Thermal shutdown
- Cycle-by-cycle over current protection

## Applications

- MR16 LED spotlight
- LED illuminance
- LED street lamp

## Block Diagram



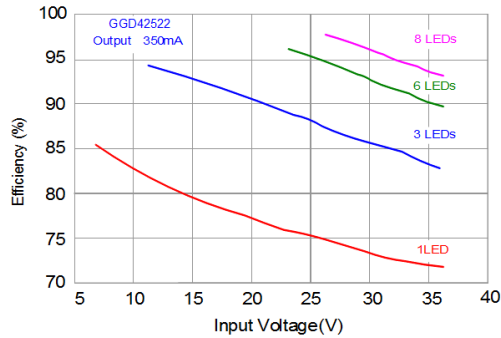
## Absolute Maximum Ratings (Operating Temperature Range Applies Unless Otherwise Specified)

Characteristics	Symbol	Ratings	Unit
Supply Voltage	VIN	40	V
Switch Voltage	VSW	-1~VIN+1	V
Comp Voltage	VCOMP	-0.3~6	V
SENSE voltage	VSENSE	-0.3~VIN	V
Junction Temperature	Tj	150	°C
Lead Temperature	TL	260	°C
Storage Temperature	TSTG	-65~150	°C
Input Voltage	VIN	6~40	V
Operating Temperature	TOPR	-40~125	°C

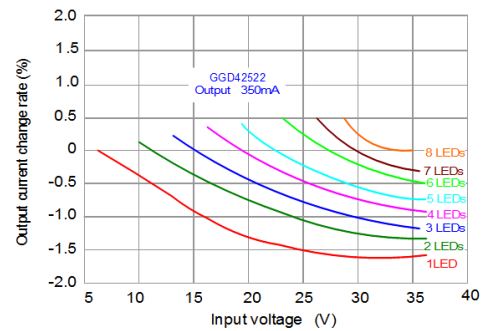
## Electrical Characteristics (Unless otherwise specified, VIN=12V, IOUT=700mA, Tamb=25°C)

Characteristics	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Supply Voltage	VIN		6	--	36	V
Operating Current	IIN	VCC=6/40V	--	1.5	2.0	mA
Upper Switch Leakage	IL	VSW=36V	--	0	10	μA
Current Limit	ILIM	VIN=SENSE=12V	1.6	1.9	2.2	A
Maximum Duty Cycle	Dmax	3LED, VIN=9V	--	93	95	%
Oscillator Frequency	fosc		250	280	320	kHz
COMP Clamp Voltage	VCOMP	Open without load	1.6	1.9	2.2	V
Switch Transistor on Resistance	RON	1LED, IOUT=0.7A	--	0.4	0.6	Ω
VDD voltage	VDD	No load	5.0	5.2	5.4	V
Sampling Voltage Threshold	VIN-VSENSE	Drop voltage between VIN and SENSE	--	88	--	mV
Thermal Shutdown Threshold	TSD		--	160	--	°C
Thermal Shutdown Hysteresis	TSD-hys		--	30	--	°C

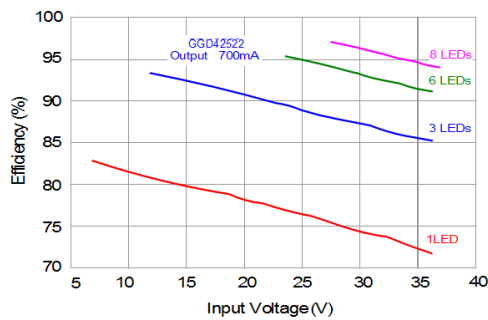
## Typical Characteristics



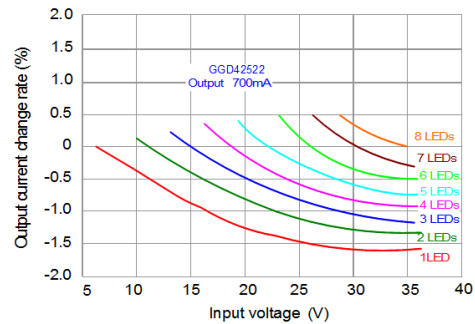
Output 350mA efficiency changed following the input voltage



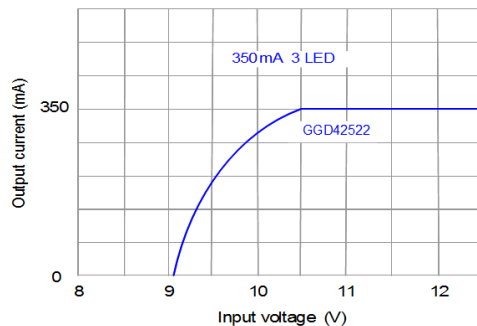
Output 350mA current change rate following the input voltage change



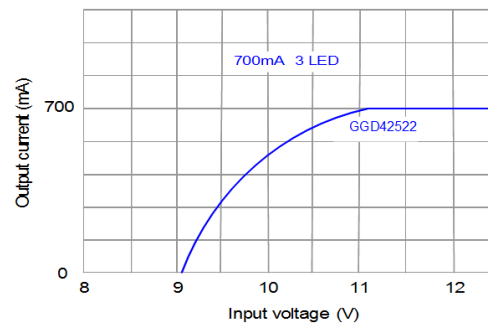
Output 700mA efficiency changed following the input voltage



Output 700mA current change rate following the input voltage



Output current change curve when input voltage is close to output voltage(350mA)



Output current change curve when input voltage is close to output voltage(700mA)

## Functional Description

The GGD42522 is a current mode LED driver. The voltage on compensation pin COMP is proportional to the current delivered to the load.

At the beginning of a cycle: the upper transistor M1 is off; the COMP pin voltage is higher than the current sense amplifier output; and the current comparator's output is low. The rising edge of the 280KHz CLK signal sets the RS Flip-Flop whose output turns on M1 thus VIN, Rs, LED, inductor and M1 comprises a circuit loop and the inductor current increases. The inductor current is sensed and amplified by the current sense amplifier. Ramp compensation is summed to current sense amplifier output and compared to the Gm amplifier output by the current comparator. When the current sense amplifier plus ramp compensation signal exceeds the comp pin voltage, the RS Flip-Flop is reset and the chip reverts to its initial M1 off state. The inductor energy storage released via the circuit loop composed by Rs, LED, inductor and M1 and the current decreases. When next clock cycle arrives, the upper transistor M1 is on to enter next switch cycle. If the current sense amplifier plus slope compensation signal does not exceed the comp voltage in one cycle, then the falling edge of the CLK resets the Flip-Flop.

The Gm amplifier compares the output current with the threshold current (threshold current is set by internal). When the output current is higher than threshold current, the COMP pin's voltage is lower down. Since the COMP pin's voltage is proportional to the peak inductor current a decrease in its voltage decreases current delivered to the output. When the output current is lower than threshold current, the COMP pin's voltage is up while the output current increases. The output current is stable at the set value by adjusting the circuit loop.

### 1. Output current setting

The output current is determined by the sampling resistor and setting voltage. The sampling voltage of VIN-VSENSE(Drop voltage on Rs) is 88mV, and adjust the output current by adjusting the sampling resistor Rs (refer to Typical Application Circuit).

$$I_{OUT} = \frac{V_{IN} - V_{SENSE}}{R_S}$$

The resistance of Rs should be smaller than 1.8Ω for the normal operation of the system.

### 2. Current limiting

GGD42522 has internal current limiting function, and the voltage on COMP is clamped at about 1.6V, the output current of the power MOSFET is limited at about 1.9A by current comparator.

### 3. Frequency jitter

GGD42522 has internal frequency jitter function to improve the EMI performance of the system. The internal frequency is hopping in a very small range to reduce the single frequency radiation which simplifies the EMI design.

## Components Selection

### 1. Input Capacitor Selection

The input capacitor provides the pulse current when the power MOSFET is on, and charge the capacitor when the power MOSFET is off, thus to keep the stability of the input voltage. The input capacitor is recommended to be more than 10μF, which can reduce the peak current drawn from input source and the switch noise. The input capacitor should be near to the input pin in real routing.

### 2. Output Capacitance Selection

Parallel connecting a capacitor between the two ends of LED can reduce the output voltage ripple accordingly reduce the ripple current of LED, while this capacitor will not effect the operating frequency and efficiency, but the start time will be longer by reducing the rising speed of the voltage on LED. The larger the output capacitor is, the smaller the current ripple on LED is. It is recommend use the capacitor of 2.2μF or larger.

### 3. Inductance Selection

The inductance is used to keep the output current constant, the bigger the inductance is, the smaller the output current ripple is; while the bigger the physical size is, the bigger the series-wound resistor is. The selected effective current (RMS current rating) of inductance current should be bigger than the maximum output current, and the saturation current should be 30% bigger than maximum output current. In order to improve the efficiency, the series-wound resistor (DCR) of inductance should be smaller than 0.2Ω.

The relation between inductance and ripple:

$$L = V_{OUT} * \frac{V_{IN} - V_{OUT}}{V_{IN} * f * \Delta I}$$

Where: L: Inductance value

F: Oscillator frequency

ΔI is ripple current

When select inductance, you should consider the combination of various factors to select suitable inductance.

### 4. Diode Selection

GGD42522 is a non-synchronous step-down adjuster, so the diode should provide continuous current when the power MOSFET is off. Because the forward voltage of Schottky diode is small, and the reverse continuous current time is short, so it is usually used for continuous current. During the power MOSFET is conducting, the diode will withstand high voltage, so the reverse voltage of selected diode should be bigger than the input voltage.

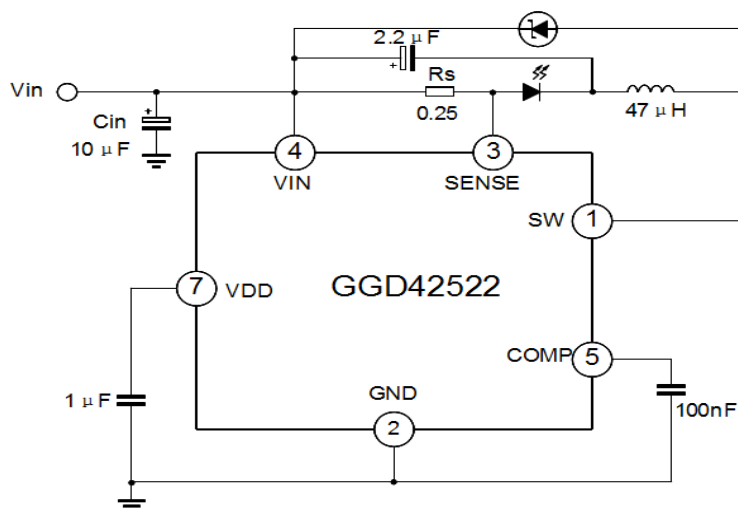
The average current through the diode is  $I_D$ :

$$I_D = (1-D) * I_{LED}$$

$I_{LED}$  is the current of LED

When the input voltage is high with a small duty,  $I_D$  increases, so the selected maximum continuous current diode should be bigger than the output current.

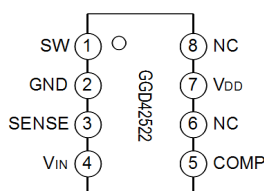
## Application Circuit



6~36V input voltage, 350mA output LED driver

Note: The above circuit and parameters are for reference only; please set the parameters of the real application circuit based on actual testing.

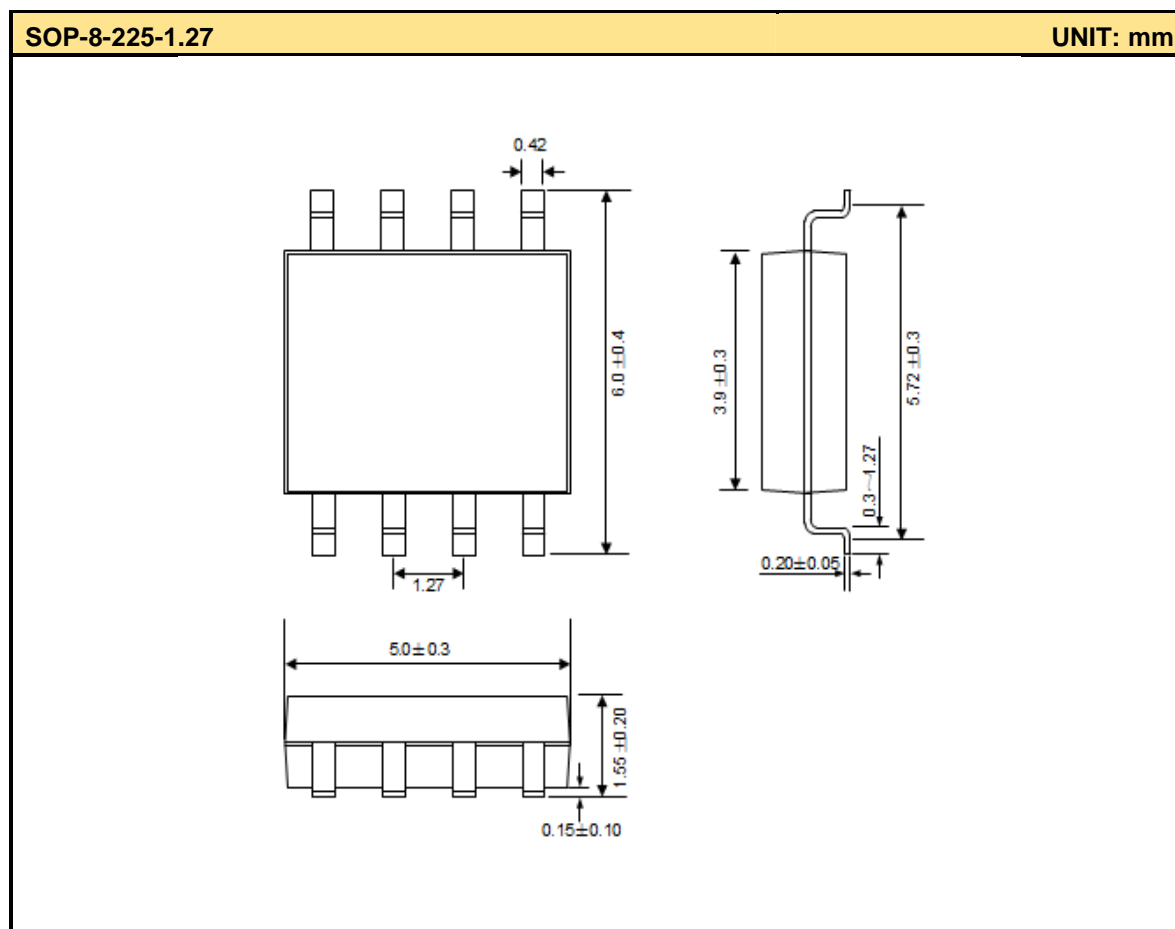
## Pin Configuration



## Pin Description

Pin No.	Pin Name	I/O	Description
1	SW	I	Power output.
2	GND	O	Ground.
3	SENSE	I	Current sense pin.
4	VIN	O	Input supply voltage.
5	COMP	I/O	Compensation pin, connects to external capacitor.
6	NC	-	No Connected.
7	VDD	I	5.2V reference output.
8	NC	-	No Connected.

## Package Outline



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