

# PC6030

**A High Efficiency Buck Converter for LED Lighting**

60V 3A Internal MOSFET Step-Down Converter

# PC6030

## A High Efficiency Buck Converter for LED Lighting

### 1. General Description

PC6030 is a high efficiency step-down (Buck) Converter with a power MOSFET for LED driver IC which provide a solution for MR16.

General lighting of flat panel displays and general DC voltage LED applications. The PC6030 has built-in high-side current sensing circuit and protection circuit such as thermal shut down, current limit. It can use both PWM and analog dimming control. The PC6030 is available in an 8-SOIC package.

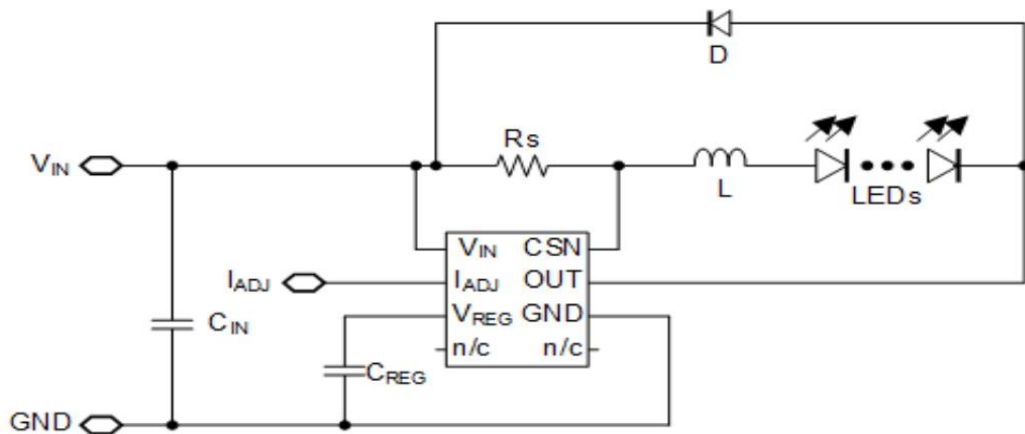
### Features

- 6.5V to 60V Input Voltage Range
- Single pin On/Off and Brightness Control using DC Voltage and PWN
- High-Side Current Sense with a power MOSFET
- 30kHz Maximum dimming frequency
- Hysteretic Buck Control
- Up to 2MHz Switching frequency
- $\pm 2.5\%$  LED Current Accuracy
- Thermal Shut down
- +5V Internal regulator
- -40 to 125°C Operating Temperature Range

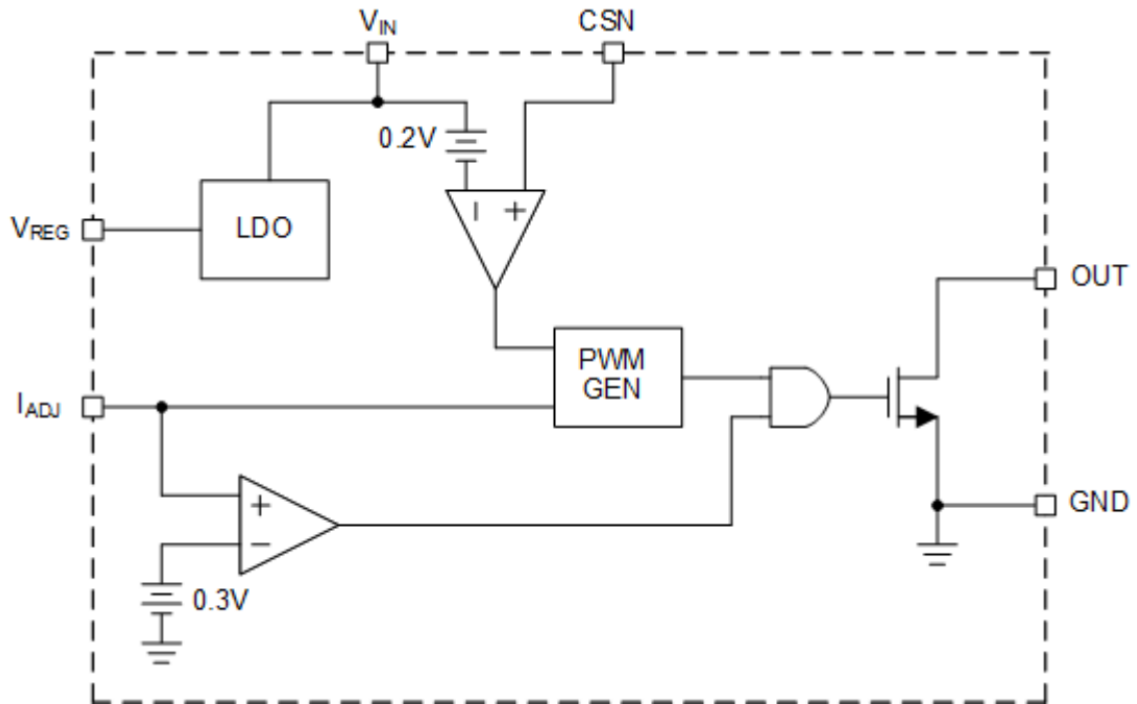
### Application

- MR16 Lighting
- Offline LED Lamps and fixtures
- General Lighting of flat panel displays
- RGB Backlighting LED driver
- Current Stabilizer with DC/DC or AC/DC
- General purpose LED Lighting

### Typical Application Circuit

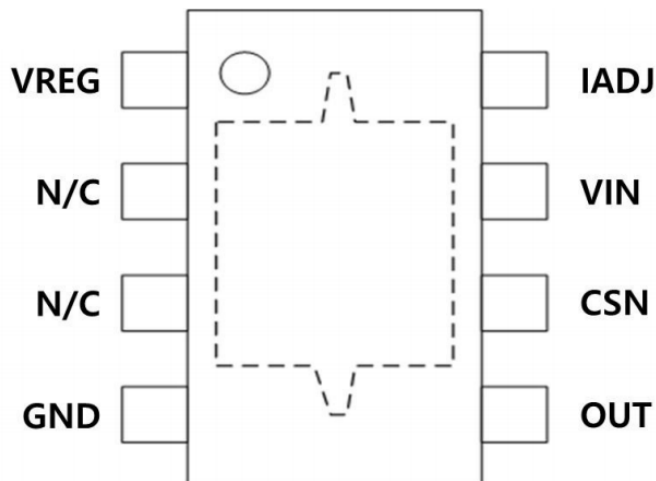


## 2. Block Diagram



## 3. Pin Information

### ▪ Pin Placement



### 3. Pin Information

#### ▪ Pin Description

1	VREG	Power Regulator output. It requires 1uF Capacitor between GND.
2	N/C	No Connection
3	N/C	No Connection
4	GND	Ground pin
5	OUT	Output for driver
6	CSN	Current sense input. Connect a resistor between VIN
7	VIN	Supply Voltage input. (6.5V to 60V). It needs 1uF or above value of capacitor between GND.
8	IADJ	PWM / Analog dimming input. If it does not use dimming function, connect to VIN

### 4. Absolute Maximum Ratings<sup>(1)</sup>

Symbol	Parameter	Ratings	Unit
$V_{VIN}, V_{CSN}$	Input Voltage, CSN Voltage	60	V
$V_{OUT}, V_{VREG}, V_{IADJ}$	Output, Regulator, IADJ Voltage	-0.3 to 6	
$V_{CSN}$	CSN to VIN Voltage	-0.3 to 0.3	
$\theta_{JA}^{(2)}$	Package Thermal Resistance	74	°C/W
$T_{JOPR}$	Junction Operating Temperature	-40 to 125	°C
$T_{STG}$	Storage Temperature	-65 to 150	

**Note :**

- (1) Stresses above the max. Values listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Maximum ratings are absolute ratings; exceedingly only one of these values may cause irreversible damage to the integrated circuit.
- (2)  $\theta_{JA}$  is measured in the convection at  $T_A=30^{\circ}\text{C}$  on a high effective thermal conductivity test board (4 Layers, 2S2P) of JEDEC 51-7 thermal measurement standard. PCB dimension is 100 × 100 × 1.6 (mm) and 4 Layers.

### 5. Recommended Operating Conditions

Symbol	Parameter	MIN	TYP	MAX	UNIT
IN	Supply Voltage	6.5	-	60	V

## 6. Electrical Specification

IN=12V, VCC=IADJ, CVCC=1uF, RCSN=2Ω, typical values are at TA=+25°C, unless otherwise specified

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
Input Voltage Range	VIN	-	6.5	-	60	V
Under Voltage Lockout	UVLOVREG	VIN=VCSN, VIN rising from 0V	-	6.5	-	
Under Voltage Lockout hysteresis	UVLOHYS	VIN=VCSN, VIN rising from 12V	0.2	0.5	0.8	
Quiescent Current	IQ	DRV is open	-	-	600	μA
Maximum Switching Frequency	fSW, MAX	IADJ=VREG, OUT pin switching frequency	2	-	-	MHz

### Current Sense Comparator

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
CSN Voltage Threshold	VCSN	IADJ=2V	195	200	205	mA
CSN Input Current	ICSN	$V_{IN} - V_{CSN} = 200mV$	-	-	5	μA
Propagation Delay to Output High	TPH	IADJ=2V, Falling edge of (VIN-VCSN) from 0.26V to 0V to DRV high	-	40	-	ns
Propagation Delay to Output Low	TPL	IADJ=2V, Falling edge of (VIN-VCSN) from 0.26V to 0V to DRV Low	-	40	-	ns

### Output Driver

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
Power Transistor $R_{DS,ON}$	RDS,ON	Output power transistor turn on resistance (Iout=1A)	-	0.3	-	Ω

### Current Sense Comparator

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
Regulator Output Voltage	VCC	IVCC=0.1mA to 10mA, VIN=6.5V to 60V	4.5	5.0	5.5	V
Sourcing Current	ISOURCE	VIN=5V, VCC=0V	400	-	-	mA
		VIN=5V, VCC=4.5V	90	-	-	
Drop-out Voltage	VDO	VIN=4.5, I=1mA	-	-	100	mV
Regulator Output Delay Time	TREG	(Slew rate of VIN) = 12V / 10us $V_{REG}=0$ to 5V	-	-	1	ms
Thermal Shutdown <sup>(1)</sup>	TTSD	-	-	150	-	°C
Thermal Shutdown Hysteresis	THYS	-	-	30	-	

#### Note :

(1) Guaranteed by characterization and design

## ▪ Electrical Specification Dimming

IN=12V, VCC=IADJ, CVCC=1uF, RCSN=2Ω, typical values are at TA=+25°C, unless otherwise specified

### Dimming

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
Dimming frequency	$F_{DIM}$	-	-	-	30	kHz
Dimming Input Voltage High	$V_{IH}$	-	2.5	-	-	V
Dimming Input Voltage Low	$V_{IL}$	-	-	0.3	-	
Maximum Duty	$S_{MAX}$	-	-	-	95	%
Minimum Duty	$S_{MIN}$	-	5	-	-	
External Control Voltage Range on IADJ pin for DC Brightness Control <sup>(1)</sup>	$V_{IADJ}$	-	-	0.35	2.5	V
DC Voltage on ADJ pin to Switch device from active On-State to quiescent Off-State	$V_{IADJ\_OFF}$	-	-	0.325	-	

#### Note :

(1) 100% brightness corresponds to VIADJ=2.5V. Driving the IADJ will increase output current proportionally

## 7. Detailed Descriptions

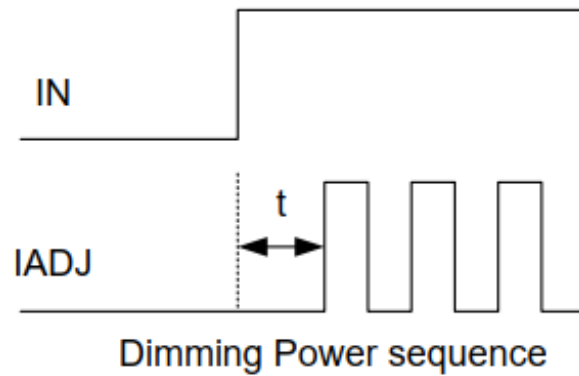
### ▪ Setting Output Current

$I_{OUT} [mA] = 200 [mV] / RCSN [\Omega]$ , VCC=IADJ

RCSN [Ω]	IOUT [mA]
0.2	1000
0.285	700
0.333	600
0.4	500
0.5	400
0.666	300
1	200

## ▪ Power Sequence

In order to use the analog/PWM dimming control, the minimum 1ms waiting time after  $V_{IN}$  applied is needed for a proper operation. If either dimming control is not selected,  $I_{ADJ}$  pin has to connect to  $V_{REG}$  or  $V_{IN}$  for a constant current operation



## ▪ UVLO

FC9961 operates when the input voltage is above 6.5V and it stops operations when the input voltage is down to 6V. This is done by UVLO block.

## ▪ Duty

It is ratio of input voltage and output voltage(LED  $V_f$ ). The maximum duty of FC9961 is around 95% and the minimum duty is about 5%. If the duty determined by the ratio of LED drop voltage over input voltage is bigger than the maximum value, the average current is less than the calculated value from current setting table.

## ▪ Dimming

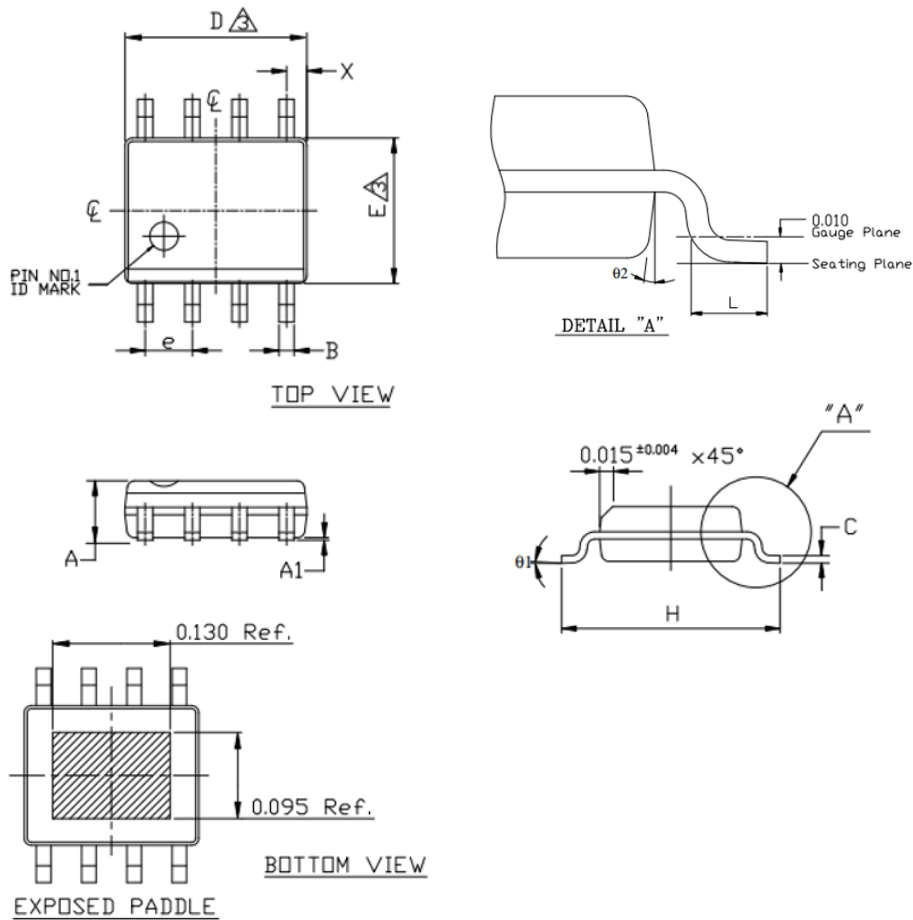
FC9961 can support analog and PWM dimming function. The analog dimming ranges are 0.3~2.5V, the output current can be adjusted. The PWM dimming can be directly applied to the  $I_{ADJ}$  pin and the maximum PWM dimming frequency is around 30kHz.

## ▪ Protection of Temperature

FC9961 has internal over-temperature protection circuit when the internal Junction temperature of IC goes over 150 degrees, the IC shuts down the IC until the temperature goes down to 120 degrees.

## Package Outline

<b>Package Name</b>	8SOIC_E
<b>Package Size</b>	6.2 × 5.0 mm , Thickness = 1.52 mm
<b>Pin Pitch</b>	1.27 mm



Unit : mm

SYMBOL	8 SOIC	
	MIN	MAX
<b>A</b>	0.054	0.068
<b>A1</b>	0.001	0.004
<b>B</b>	0.014	0.019
<b>D</b>	0.189	0.196
<b>E</b>	0.150	0.157
<b>H</b>	0.229	0.244
<b>e</b>	0.050 BSC	
<b>C</b>	0.0075	0.0098
<b>L</b>	0.020	0.040
<b>X</b>	0.0215 REF	
<b>01</b>	0°	8°
<b>02</b>	7° BSC	

### Note :

- (1) Top Package surface to be matte finish VDI 24~27
- (2) Bottom Package surface to be matte finish VDI 8~11
- (3) Dimension are exclusive mold flash and gate Burr
- (4) Foot length measuring is based on the gauge plane method