LED Lighting IC

LC5222D

13 October 2011

◆Description

LC5222D is non-isolated type driver IC for LED lighting which can achieve high efficiency in simple circuitry. Its compact package which includes output MOSFET and controller, and low external components are suitable for small lighting equipment which requires saving space, like LED light bulb.

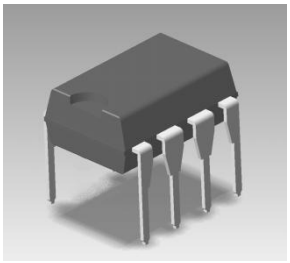
To meet various requirements, Buck-Boost operation which has wide input/output capability is available. And also, control functions with Ref input are implemented.

Its high voltage capability allows direct connection to rectified AC supply.

Open protection for Buck-Boost operation and variable OCP improve safeness.

◆Package

Package: DIP8



◆Applications

- LED Lighting equipment
- LED Light bulb

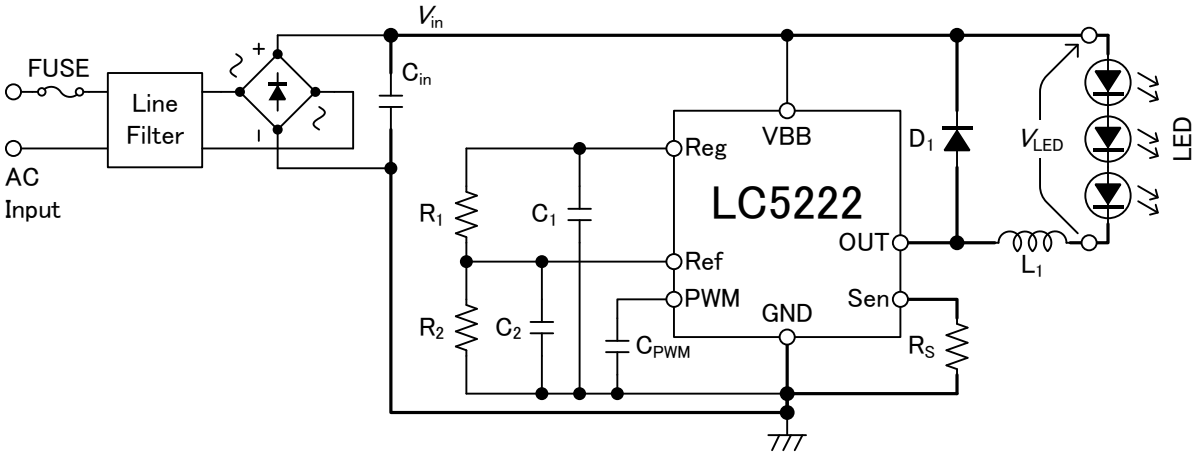
◆Main Specification

MOSFET	250V (MIN), 2.2Ω (MAX)
Output Current	0.5A (MAX)
Main Supply Voltage	250V (MAX)

◆Features

- Buck-Boost operation
  In addition to normal Buck operation, Buck-Boost operation which can both Step-up and down is also available, to operate in wide input/output condition.
- Open protection for Buck-Boost operation
  Protection circuit to prevent damage when load open failure in Buck-Boost operation.
- Built-in reference voltage for current setting
  Precision and easy current setting.
- Sleep function
  Latch off the output by Ref pin input voltage.
- Disable function
  Shut off LED current by Ref pin input voltage.
- DIP8 Package
  Output MOSFET and controller are included in one package.
- High voltage supply input
- Built-in constant current controller
  - PWM mode current control circuitry.
  - Adjustable output current by input voltage to Ref pin.
- External PWM Dimming
- Variable type over current protection (OCP)
  - Latch type operation
  - OCP threshold is adjusted by setting current and temperature to ensure protection.
- Under voltage lockout protection (UVLO)
- Thermal Shutdown protection (TSD)

Typical application circuit



1 Scope

The present specifications shall apply to a LED driver IC for LED lighting, LC5222D.

2 Outline

Type	Hybrid Integrated Circuit
Structure	Plastic Molded (Transfer Mold)
Applications	LED Lighting

3 Absolute Maximum Ratings (Ta=25℃)

Parameter	Terminal	Symbol	Ratings	Units	Remarks
Main Power Supply Voltage	6−8	V_{BB}	250	V	
Output Breakdown Voltage	5−4	Vo	250	V	
Output Current	5−4	I_O	0.5※1	A	Exclude Pulse Width<1μs
PWM Pin Voltage	2−8	V_{PWM}	−0.3～V_Z※2	V	
Ref Pin Voltage	3−8	V_{Ref}	−0.3～V_Z※2	V	
Sen Pin Voltage	4−8	V_{Sen}	−0.3～4.0	V	Exclude Pulse Width<1μs
Allowable Power Dissipation	—	P_D	1.73※3	W	Mounted on PWB※4
Junction Temperature	—	T_j	150	℃	
Operating Temperature Range	—	T_a	−40～105	℃	
Storage Temperature Range	—	T_{stg}	−40～150	℃	

※1 Output current rating may be limited by duty cycle, ambient temperature, and heat sinking. Under any set of conditions, do not exceed the specified junction temperature (T_j).

※2 V_Z here is breakdown voltage of zener diode which is internally connected to between pins and GND. (V_Z=6.3V typ.) Maximum input current is 1mA.

※3 Allowable Power Dissipation depends on PWB pattern layout.

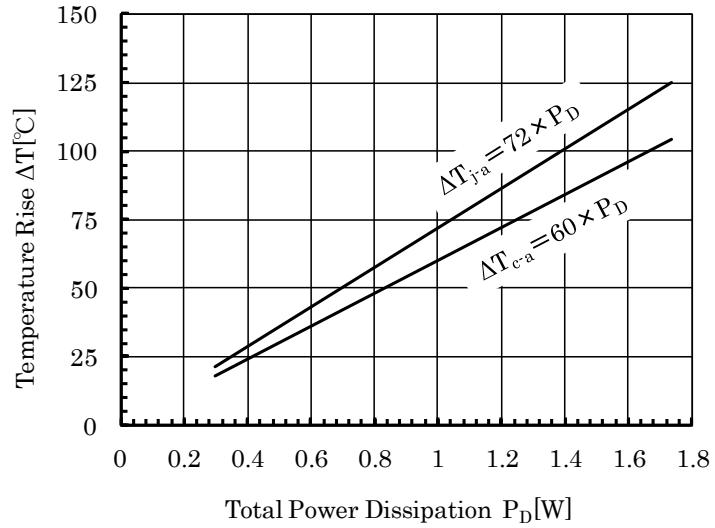
※4 Mounted on Sanken evaluation board.

4 Electrical Characteristic (Ta=25°C, V_{BB}=140V, Unless Otherwise Noted.)

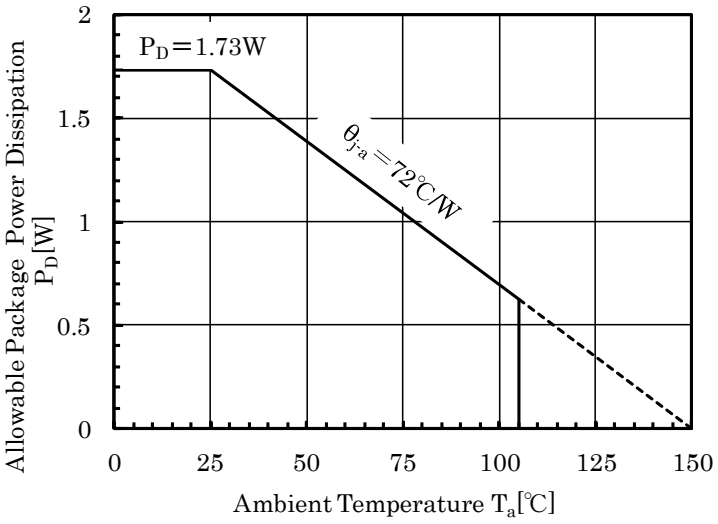
Parameter	Terminal	Symbol	Ratings			Units	Remarks
			MIN	TYP	MAX		
Power Supply Current	6−8	I_{BBs}	—	1	1.5	mA	At disable
	6−8	I_{BB}	—	2.5	4.0	mA	At enable
Output MOSFET Breakdown Voltage	5−4	$V_{(BR)DSS}$	250	—	—	V	I_D=1mA
Output MOSFET On Resistance	5−4	$R_{DS(on)}$	—	1.2	2.2	Ω	I_D=0.5A
Body Diode Forward Voltage	4−5	V_F	—	0.8	1.0	V	I_F=0.5A
UVLO Threshold (Turn On)	6−8	$V_{UVLO(on)}$	—	14	—	V	
UVLO Threshold (Turn Off)	6−8	$V_{UVLO(off)}$	—	12	—	V	
Reg Output Voltage	1−8	V_{Reg}	9.6	10	10.4	V	I_{Reg}=0mA
Reg Output Current	1−8	I_{Reg}	—	—	−2	mA	V_{Reg}=9V
Enable Voltage	3−8	V_{ENB}	—	0.15	0.19	V	
Sleep Voltage	3−8	V_{SLP}	2.85	3.0	—	V	
Ref Pin Input Current	3−8	I_{Ref}	−10	—	10	μA	
Current Control Detection Voltage	4-8	V_{Sen}	$0.4V_{Ref}$ −0.03	$0.4V_{Ref}$	$0.4V_{Ref}$ +0.03	V	V_{Ref}=0.2~2.0V
			0.77	0.8	0.83	V	V_{Ref}=2.0~3.0V
OCP Detection Voltage	4−8	V_{OCP}	—	$0.4V_{Ref}$ +0.7	—	V	V_{Ref}=0.2~2.0V
			—	1.5	—	V	V_{Ref}=2.0~3.0V
Sen Pin Input Current	4−8	I_{Sen}	−10	—	10	μA	
PWM Pin Low Voltage	2−8	V_{PWML}	—	2	—	V	
PWM Pin High Voltage	2−8	V_{PWMH}	—	3	—	V	
PWM Pin Output Current	2−8	I_{PWM}	—	−20	—	μA	
PWM Blanking Time	—	t_{BLKP}	—	0.3	—	μs	
OCP Blanking Time	—	t_{BLKO}	—	0.2	—	μs	
PWM Frequency	2−8	f_{PWM}	—	—	200※5	kHz	Duty=50%
PWM Off Time	—	t_{Off}	—	17	—	μs	C_{PWM}=100pF
Rise Time	5−4	t_r	—	25	—	ns	I_o=0.4A
Fall Time	5−4	t_f	—	50	—	ns	I_o=0.4A
Thermal Shutdown Threshold	—	T_{TSD}	—	150	—	°C	Temperature of Control IC
Thermal Shutdown Hysteresis	—	T_{TSDhys}	—	55	—	°C	

※5 Operation at a PWM frequency greater than f_{PWM} is possible but not warranted.

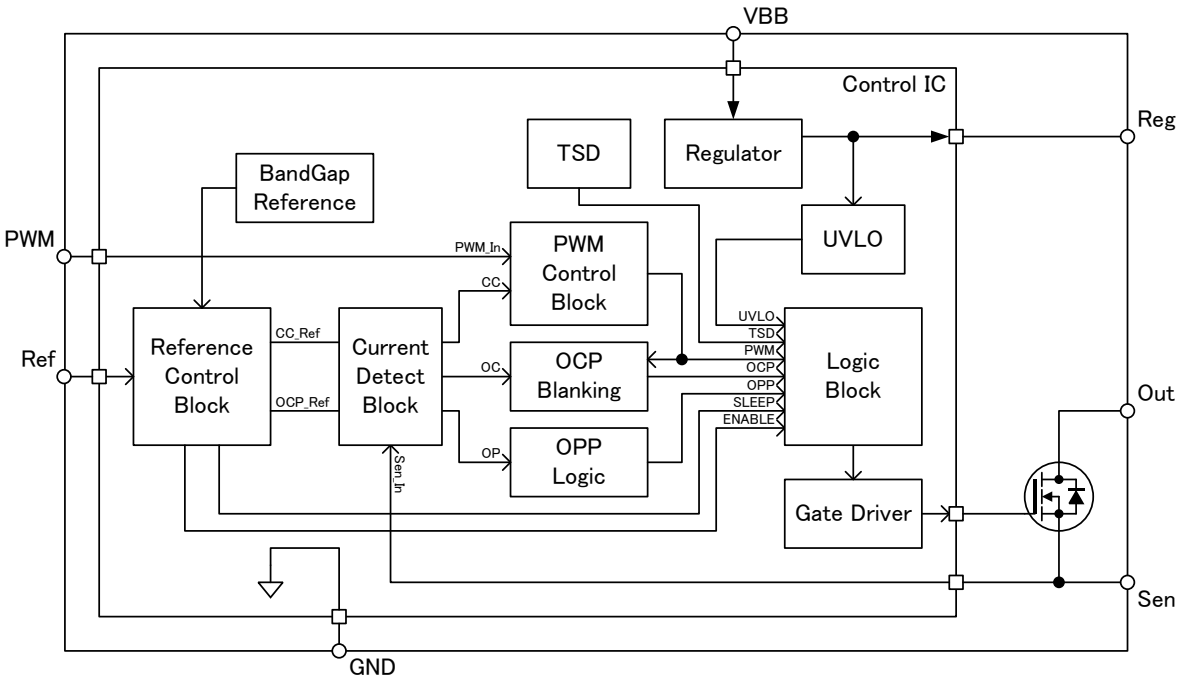
Thermal Data



Power Dissipation versus Ambient Temperature



5 Functional Block Diagram (Pin assignment)



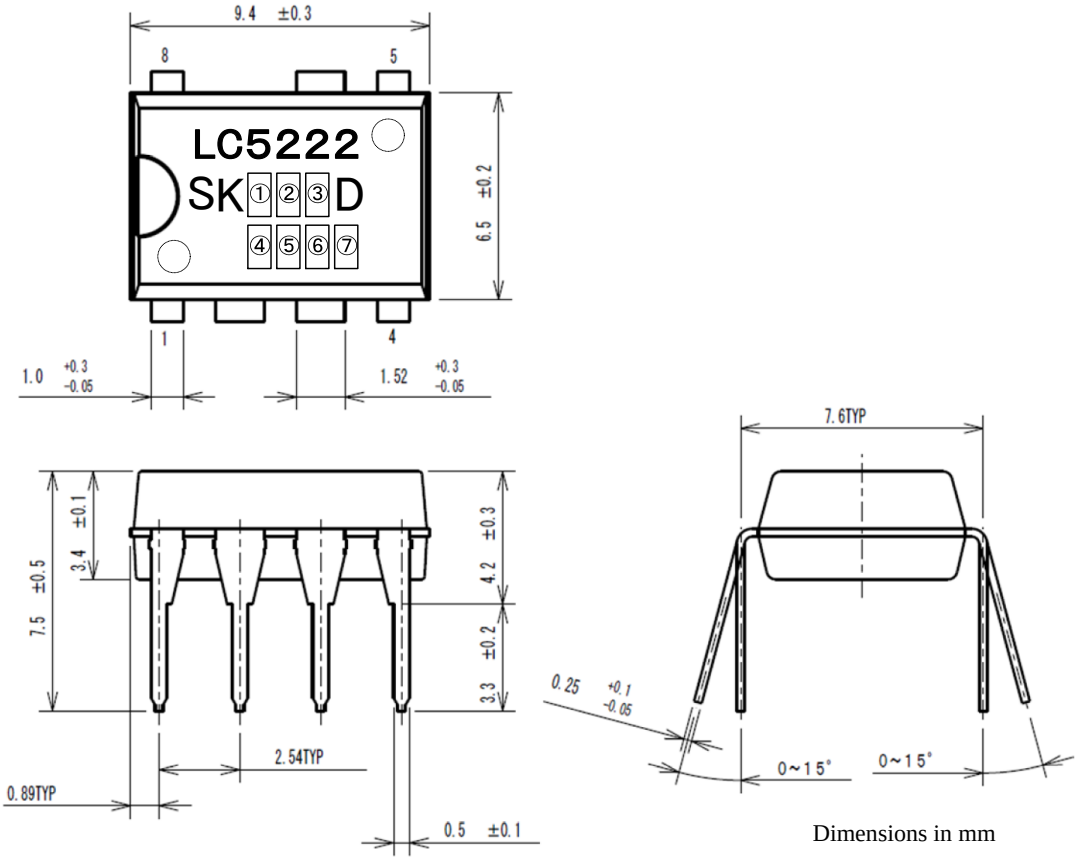
Pin Assignment

Number	Name	Function
1	Reg	Output of 10V Internal Regulator
2	PWM	PWM Control
3	Ref	Setting Output Current and Operation
4	Sen	Current Sensing
5	OUT	Output (Power MOSFET Drain)
6	VBB	Power Supply
7	—	Pin Removed
8	GND	Ground

6 Package

6.1 Package Drawing and Material

- DIP8 Package



Dimensions in mm

Terminal material: Cu

Terminal treatment:
Solder plating (Pb-free)

Marking

Position	Contents	Indication
①	The last digit of the year	0 to 9
②	The Month	1 to 9,O,N,D
③	The week	1 to 3
④	Sanken Registration Number	alphanumeric characters
⑤		
⑥		
⑦		

6.2 Appearance

The body shall be clean and shall not bear any stain, rust or flaw.

6.3 Marking

The type number and lot number shall be clearly marked by laser so that cannot be erased easily.

7 Cautions and warnings

Since reliability can be affected adversely by improper storage environment and handling methods during Characteristic tests, please observe the following cautions.

7.1 Cautions for Storage

- Ensure that storage conditions comply with the standard temperature (5 to 35℃) and the standard relative humidity (around 40 to 75%) and avoid storage locations that experience extreme changes in temperature or humidity.
- Avoid locations where dust or harmful gases are present and avoid direct sunlight.
- Reinspect for rust in leads and solderability that have been stored for a long time.

7.2 Cautions for characteristic Tests and Handling

- When characteristic tests are carried out during inspection testing and other standard tests periods, protect the devices from surge of power from the testing device, shorts between the devices and the heatsink.

7.3 Considerations to protect the Products from Electrostatic Discharge

- When handling the devices, operator must be grounded. Grounded wrist straps be worn and should have at least 1MΩ of resistance near operators to ground to prevent shock hazard.
- Workbenches where the devices are handled should be grounded and be provided with conductive table and floor mats.
- When using measuring equipment such as a curve tracer, the equipment should also be grounded.
- When soldering the devices, the head of a soldering iron or a solder bath must be grounded in other to prevent leak voltage generated by them from being applied to the devices.
- The devices should always be stored and transported in our shipping containers or conductive containers, or be wrapped up in aluminum foil.

7.4 Others

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