Step down - LED controller IC for external power stages
ILD4001

Small Signal Discretes

Infineon

Never stop thinking

ILD4001, Step down - LED controller IC for external power stages

Revision History: 2009-07-06, Rev. 1.0

| Page	Subjects (major changes since last revision)
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1 Bipolar Buck- converter LED Controller IC

Features

- Wide Input Voltage Range: 4.5V ... 40 V
- Over voltage protection
- Temperature shut down mechanism
- Integrated push- pull stage for fast on/off- switching
- Soft- Start capability
- Low shut down current < 200nA in operating voltage range
- Multifunctional Enable Pin
- Analog and PWM dimming possible
- PWM control for LED brightness possible
- Typical 3% output current accuracy
- Minimum external component required
- Small Package: SC-74
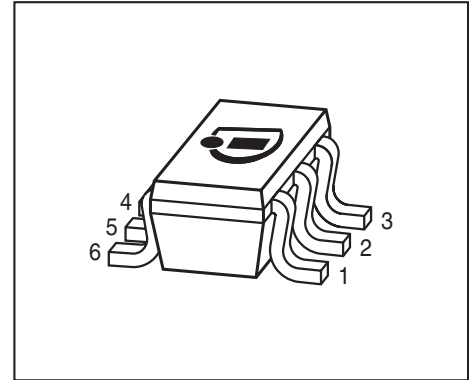
Applications

- LED Controller for industrial applications
- Universal Constant Current Source
- Generell Illumination e.g. Halogen Replacement
- Residential Architectural and Industrial Commercial Lighting for in- and outdoor
- Signal and Marker Lights for Orientation or Navigation (e.g. steps, exit ways, etc.)

2 Description

The ILD4001 is a hysteretic buck LED controller IC for industrial applications realized in a bipolar IC technology. The LED Controller is capable to drive external bipolar or MOSFET power transistors by using the internal push-pull output stage.

The IC incorporates a wide input voltage range and the output current level can be adjusted with an external sense resistor.

According to the multifunctional control pin the IC can be switched on and off by an external signal, which is also suitable to regulate brightness of the LEDs by PWM dimming.

Depending on the value of the switching inductor the switching frequency and the voltage ripple could be set.

The precise internal bandgap stabilizes the circuit and provides stable current conditions over temperature range.

Furthermore, over voltage protection and temperature shut down mechanism enforce the IC to protect attached LEDs.

Additional features are included to protect the LED's from overload, short circuit events as well as from over voltage. The LED's can be also protected against thermal overload by thermally coupling the LED's to the ILD4001.
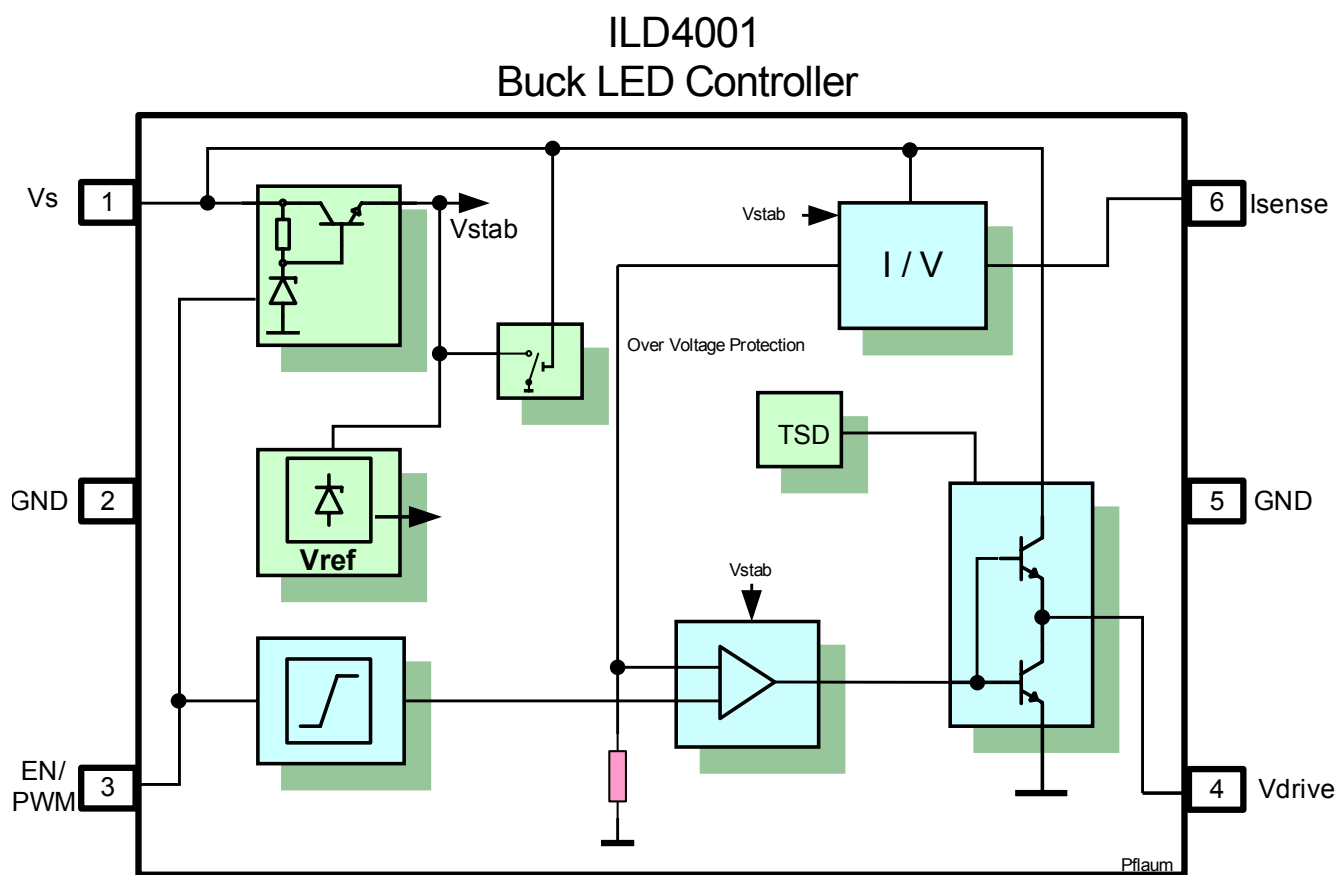
ILD4001
Buck LED Controller

Figure 1   Block diagram

Pin Definition

Table 1   Pin definition and function

Pin number	Pin Symbol	Function
1	V_s	Supply Voltage
2	GND	IC ground
3	EN / PWM	Multifunctional Pin; Power On control voltage pin *(PWM input)*
4	V_{drive}	Push- Pull Switch Output
5	GND	IC ground
6	I_{sense}	LED current sense pin

Maximum Ratings

Table 2   Maximum ratings

Parameter	Symbol	Limit Value	Unit
Supply voltage	V_s	45	V
Average Output current	I_{out}	30	mA
Total Power Dissipation; T_s= xx°C	P_{tot}	tbf	mW
Junction temperature	T_J	150	°C
Storage temperature range	T_{STG}	-65... 150	°C
ESD capability Human Body Model[1]	V_{ESD_HBM}	2000	V
ESD capability Machine Model[2]	V_{ESD_MM}	400	V

1) For ESD testing, the chip was mounted in a SC74 package on an application board, where GND is electrically connected to the chip GND

2) For ESD testing, the chip was mounted in a SC74 package, where GND is electrically connected to the chip GND

Thermal resistance

Table 3   Thermal resistance

Parameter	Symbol	Value	Unit
Junction - solder point	R_{thJS}	tbf	K/W

3 Electrical Characteristics

3.1 DC Characteristics

4.5 V < V_S < 40 V; - 40 °C < T_J < 150 °C, all voltages with respect to ground; positive; current flowing into pin; unless otherwise specified

All parameters have been measured at 25 °C, unless otherwise specified

Table 4   DC Characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Overall current consumption	Is_{short}	tbf	tbf		mA	V_s = 4.5 V; I_{out} = 10 mA
Overall current consumption	Is_{short}	tbf	tbf		mA	V_s = 40 V; I_{out} = 10 mA
Overall current consumption	Is_{short}			tbf	µA	V_s = 45 V; I_{out} = 10 mA
Overall current consumption open load	$Is_{open\ load}$		tbf		µA	V_s = 4.5 V; I_{out} = 0 mA
Overall current consumption open load	$Is_{open\ load}$		tbf		µA	V_s = 40 V; I_{out} = 0 mA
Overall current consumption open load	$Is_{open\ load}$		tbf		µA	V_s = 45 V; I_{out} = 0 mA
Overall standby current consumption	$Is_{standby}$			200	nA	EN = 0 V; V_s= 4.5 V
Overall standby current consumption	$Is_{standby}$			200	nA	EN = 0 V; V_s = 40 V
Input Current of multifunctional control pin	I_{EN}	20	40	70	µA	at any condition
Current of Sense input	I_{sense}			200	nA	at any Output current
Voltage of Sense input	V_{sense}		100		mV	
Sense threshold hysteresis	$V_{sensehys}$		+/- 15		%	
Over voltage Protection	$V_{s,\ OV}$	42			V	I_{out} -> 0 A
Lowest sufficient voltage overhead	V_{CE}		1.2		V	I_{out} < 10 mA
Temperature shut down	Th_{TSD}	115	125	135	°C	I_{out} -> 0 A; refer to T_J

3.2 AC Characteristics

All parameters have been measured at 25 °C, unless otherwise specified

Table 5   AC Characteristics

| Parameter | Symbol | Values | | | Unit | Note / |
		Min.	Typ.	Max.		Test Condition
Switching frequency	F_{sw}		200		kHz	V_s = 12 V 3 LEDs in series Rsense = 100 mΩ L = 100 µH V_{EN} = 3 V I_{LED} = 350 mA
Maximum switching frequency	F_{swmax}		500		kHz	recommended

3.3 Digital Signals

All parameters have been measured at 25 °C, unless otherwise specified

Table 6   Digital Control Parameter (EN)

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Multifunctional control pin voltage range	U_{Pon}	-0.3		40	V	
Control voltage for power on	U_{On}	2	2.2	40	V	full LED current
Control voltage for power off	U_{Off}	-0.3		0.6	V	
Control voltage for analog dimming	U_{dim}	1		2	V	linear dimming
PWM signal frequency	f_{PWM}			1000	Hz	$t_{dutycycle}$ = 1%; signal level reaches 100% in on and off mode
PWM Duty cycle	$t_{dutyPWM}$	5			%	f = 5 KHz; signal level reaches 100% in on and off mode
PWM voltage	U_{PWM}			40	V	

3.4 Transient Parameters

4.5 V < V_S < 40 V; - 40 °C < T_J < 150 °C, all voltages with respect to ground; positive; current flowing into pin; unless otherwise specified

All parameters have been measured at 25 °C, unless otherwise specified

Table 7   Digital Control Parameter (EN)

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Response Time	T_{ON}		10		µs	EN: 0 -> 5 V @ t_{rise} < 20ns I_{Out} = 10mA
	T_{OFF}		10		µs	EN: 5 V -> 0 @ t_{fall} < 20 ns I_{Out} = 10mA

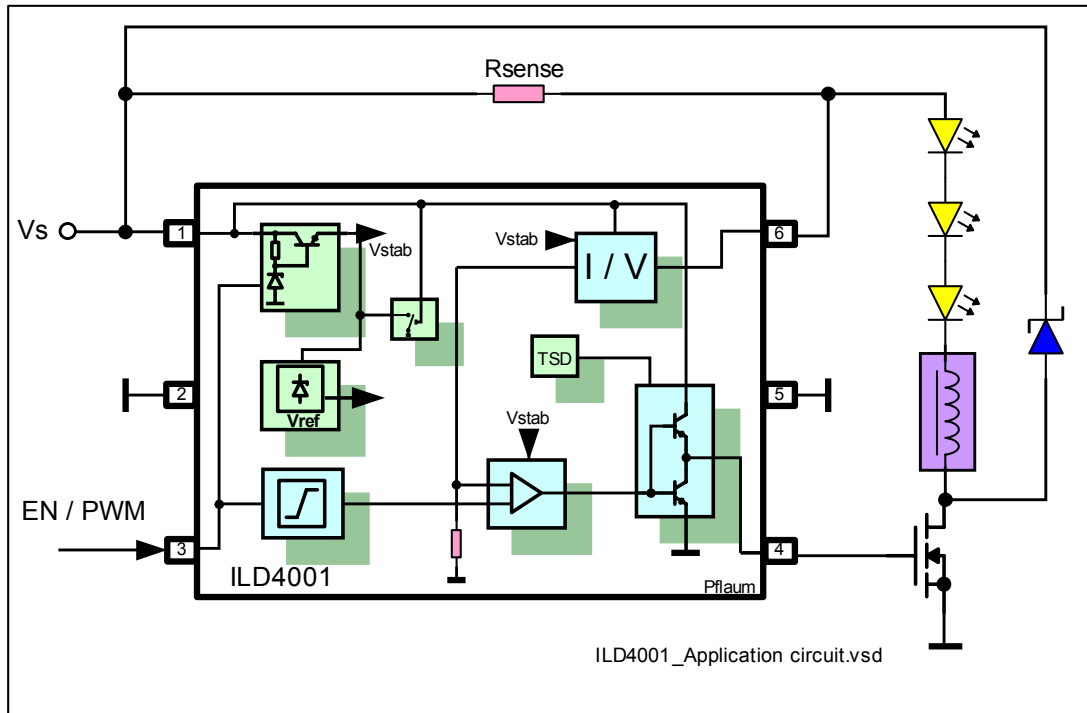# 4 Application Circuit

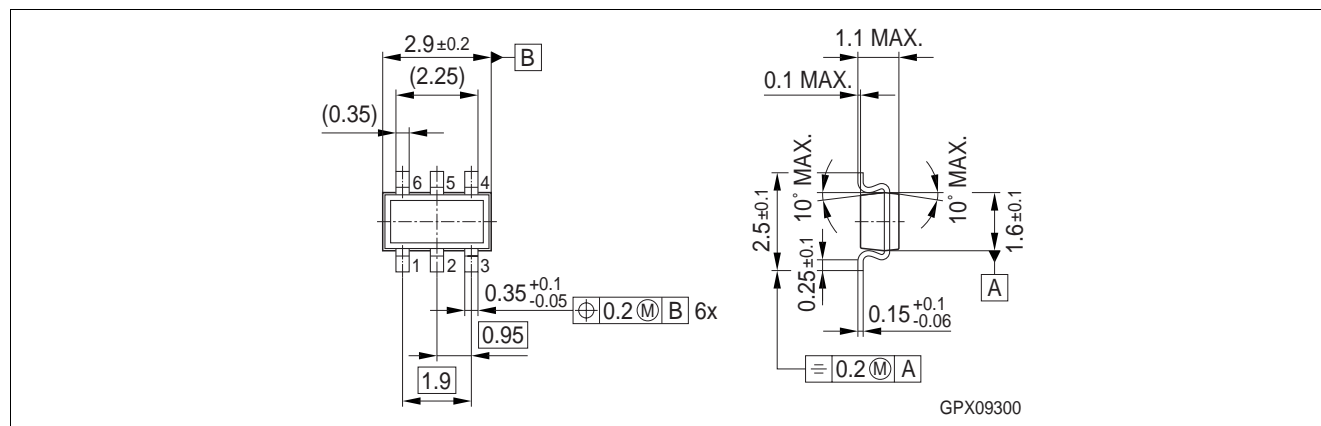**Figure 2   ILD4035; Application Circuit**

5   Package Information

Figure 3   Package Outline; SC74

Figure 4   Tape loading