

### Description

BP5136H is a high current precision Linear LED Driver, integrated with High Voltage regulation switchers and JFET supply, specially designed for AC line LED strings forwarded with high voltage and low current.

In application, it supports a quite small BOM benefit from no ECAP and no Magnetics, compile with EMI and safety standard.

BP5136H can drive precision constant current by option of an external resistor, and set up the LED strings in group linear compile with THD performance. Typical 40mA LED current is optimized for 220V line voltage. BP5136H support thermal regulation by an external resistor to prevent over driving in high input voltage.

BP5136H invite an external resistor to fulfill the line regulation and adjust the output current following input voltage.

### Features

- ◆ High integration, all SMTs in small size.
- ◆ No ECAPs and magnetics
- ◆ Integrated with 700V/500V HV MOS, saved on safety components.
- ◆ Align working with  $\pm 20\%$  tolerance on line voltage;
- ◆ Fast startup
- ◆ LED current set by external resistors with  $\pm 5\%$  accuracy.
- ◆ Programmable thermal regulation.
- ◆ Compensation for line regulation
- ◆ In SOP8-EP package.

### Application

- ◆ GU10/E27 LED retrofit lamps
- ◆ LED candle
- ◆ Other LED lighting

### Typical Application

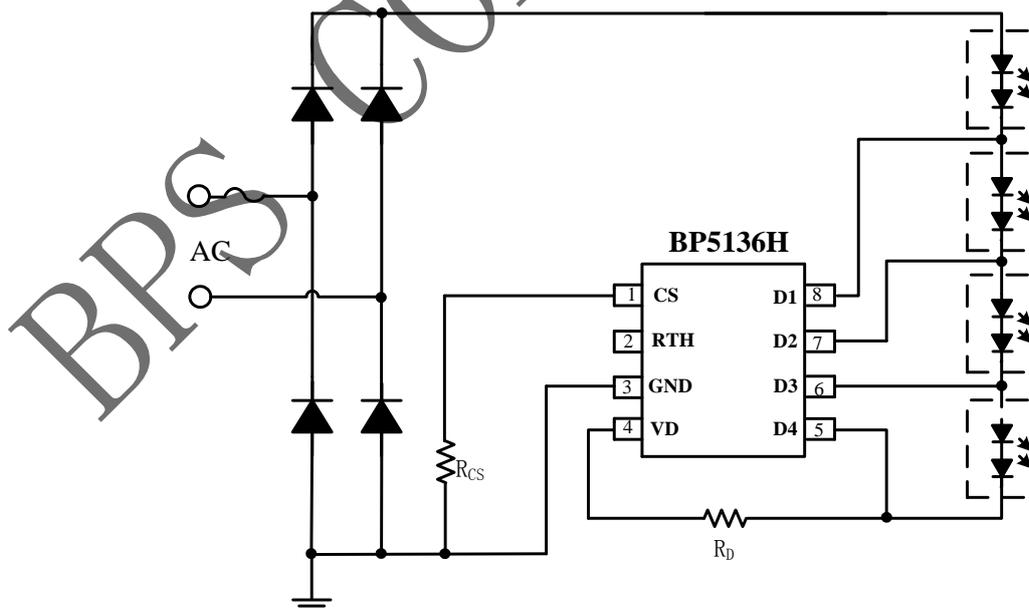


Fig.1 BP5136H Typical Application

### Order Information

Part Number	Package	Temperature	Packing Method	Mark
BP5136H	SOP8-EP	-40 °C to 105 °C	Tape 4,000 pcs/reel	BP5136H XXXXXY XYY

### Pin mapping

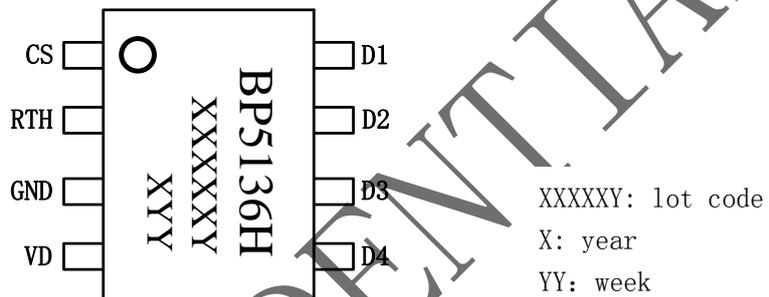


Fig 2 Pin Mapping

### Pin Descriptions

Pin No.	Pin Name	Descriptions
1	CS	Current sense, connect the current sense resistor to GND
2	RTH	Thermal regulation, need connect resistor to GND
3	GND	IC ground
4	VD	Drain Voltage, need connect resistor to Drain Pin
5	D4	Drain for LED string4
6	D3	Drain for LED string3
7	D2	Drain for LED string2
8	D1	Drain for LED string1

### Absolute Limit (Note1)

Symbol	Parameter	Range	Unit
D1, D2	700V HV interface	700	V
D3, D4	500V HV interface	500	V
CS,RTH,RD	Low voltage pins	-0.3~6	V
P <sub>DMAX</sub>	Power dissipation (note 2)	1	W
θ <sub>JA</sub>	Thermal Resistor	60	°C/W
T <sub>J</sub>	Junction Temperature	-40 to 150	°C
T <sub>STG</sub>	Storage temperature range	-55 to 150	°C
	ESD (Note 3)	2	kV

*Note 1: Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. Under “recommended operating conditions” the device operation is assured, but some particular parameter may not be achieved. The electrical characteristics table defines the operation range of the device, the electrical characteristics is assured on DC and AC voltage by test program. For the parameters without minimum and maximum value in the EC table, the typical value defines the operation range, the accuracy is not guaranteed by spec.*

*Note 2: The maximum power dissipation decrease if temperature rise, it is decided by T<sub>MAX</sub>, θ<sub>JA</sub>, and environment temperature (T<sub>A</sub>). The maximum power dissipation is the lower one between P<sub>DMAX</sub> = (T<sub>MAX</sub>-T<sub>A</sub>) / θ<sub>JA</sub> and the number listed in the maximum table.*

*Note 3: Human Body mode, 100pF capacitor discharge on 1.5kΩ resistor*

### Recommendation for operation condition

Symbol	Parameters	Range	Unit
I <sub>LED</sub>	LED output current @220V	<40	mA
I <sub>LED</sub>	LED output current @110V	<80	mA



晶丰明源半导体

# BP5136H

High Voltage Linear LED Driver

## Electrical Characteristics (note4, 5) (unless specified, otherwise $T_A=25\text{ }^\circ\text{C}$ )

Symbol	description	Test condition	Min.	Typ.	Max.	UNIT
<b>Operation Current</b>						
$I_{CC}$	Operation current	D1=30V		80	110	uA
<b>Current Sense</b>						
$V_{REF1}$	Ref. for string1	D1=30V, $R_{cs}=120\Omega$		645		mV
$V_{REF2}$	Ref. for string2	D1, D2=30V, $R_{cs}=120\Omega$		725		mV
$V_{REF3}$	Ref. for string3	D1, D3=30V, $R_{cs}=120\Omega$		805		mV
$V_{REF4}$	Ref. for string4	D1, D4=30V, $R_{cs}=120\Omega$		890		mV
<b>Thermal Regulation</b>						
$V_{RTH}$	Threshold voltage			1.0		V
$T_{REG}$	Thermal Regulation	RTH pin open		140		$^\circ\text{C}$

Note 4: production testing of the chip is performed at  $25\text{ }^\circ\text{C}$ .

Note 5: the maximum and minimum parameters specified are guaranteed by test, the typical value are guaranteed by design, characterization and statistical analysis

### Block Diagram

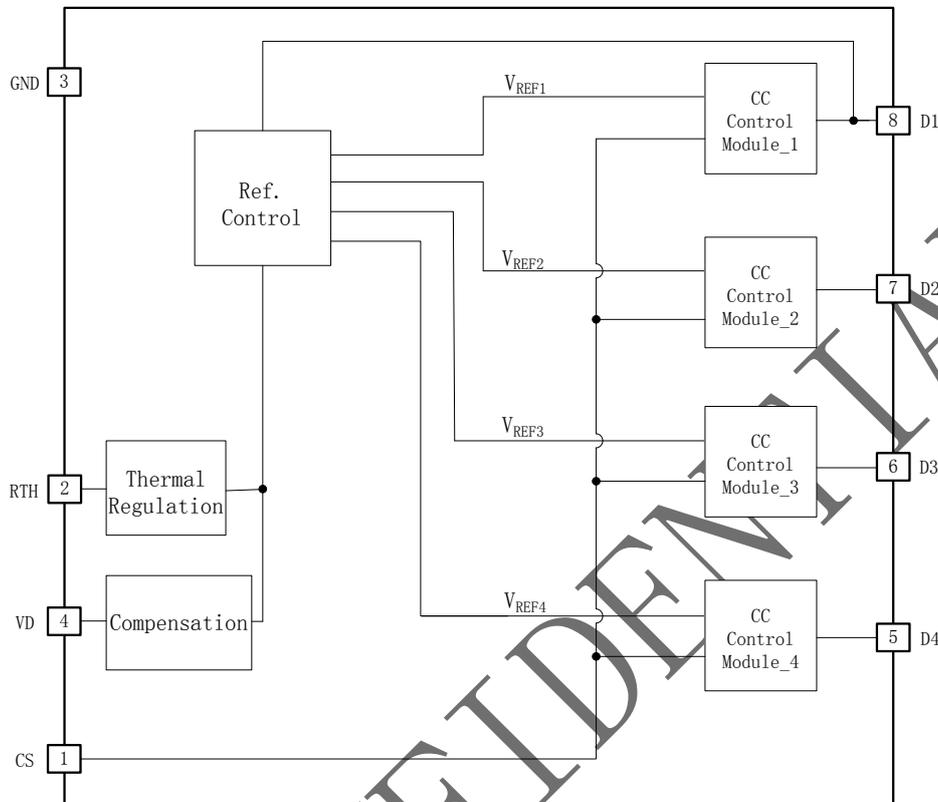


Fig3 BP5136H Block Diagram

### Application Information

BP5136H is designed for linear driving LED strings with high forward voltage low LED current in line condition.

#### 1 Supply

After system power on, the chip is supplied by JEFT through D1, starting work once voltage on D1 above 10V.

#### 2 Operation principle

BP5136H auto adjust the LED strings in working according to line voltage and extend the LED working slots in every main cycles with purpose of output  $I_m$  maintenance and LED availability improvement. For different application, the

forward voltage of summary all strings should match the input voltage, like 110V and 220V respectively.

#### 3 Current configuration

BP5136H supports high precision LED current set by external resistors.

Current for each string defined as:

$$I_{LED\_n} = \frac{V_{ref\_n}}{R_{cs}}$$

here,  $n=1,2,3,4$  refer to the different Reference Voltage for each string.

As recommended, as application case of 220V line condition, set the LED less than 40mA depend on thermal capability of heatsinking.



### 4 Thermal regulation

BP5136H has thermal regulation available to balance the power delivering and temperature increasing. To improve the system reliability, the output current to be regulated lower down refer to the junction temperature.

BP5136H has RTH pin available for thermal regulation by external resistor and the temperature threshold of thermal regulation adjusted in same tend then. As default of RTH pin open, the Voltage limit on RTH pin is 1.0V and the temperature threshold of thermal regulation is 140°C.

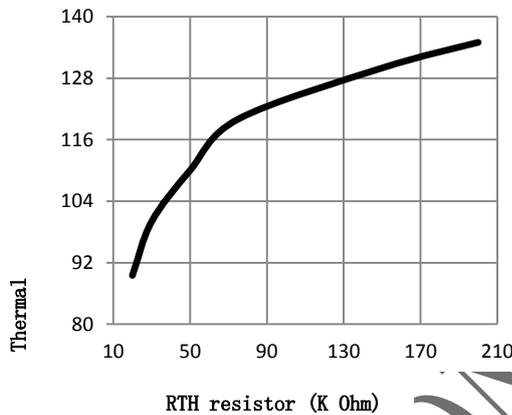


Fig4 Co-Relationship between thermal regulation and RTH resistor value

### 4 Compensation for line voltage

When LED string4 on, in order to save the power loss, the system is to decrease the LED current following voltage on D4 pin. The decreased value is defined as:

$$V_{REF4} = 0.9 - \frac{1.6k\Omega}{R_D} * V_{D4}$$

### PCB Layout design

Suggestion for BP5136H PCB layout:

#### GND

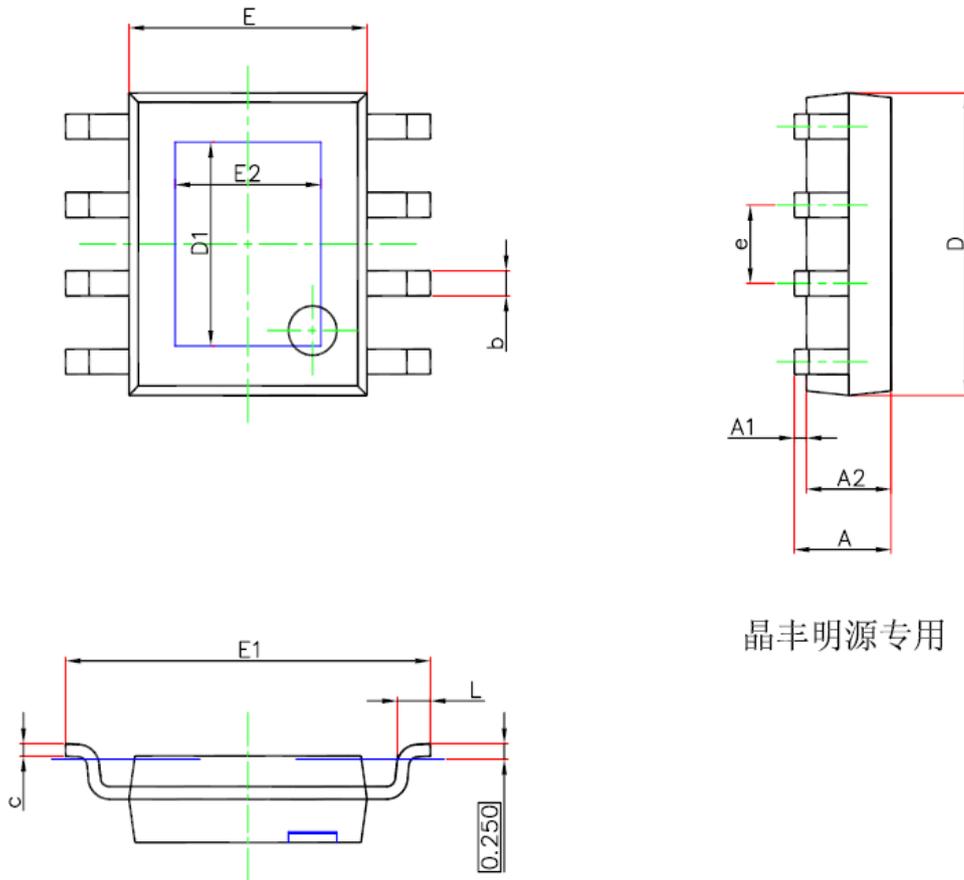
Use the trace for current sense resistor as short as possible. Extend the copper area for each Drain Pin to improve good thermal condition.

#### Heat sinking

BP5136H adopted SOP8-EP package to strengthen the thermal dissipation, so that connect explore pin to GND for further.

### Package

SOP8-EP (EXP PAD) PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.700	0.053	0.067
A1	0.000	0.100	0.000	0.004
A2	1.350	1.550	0.053	0.061
c	0.170	0.250	0.007	0.010
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	2.313	2.513	0.091	0.099
L	0.400	1.270	0.016	0.050
b	0.330	0.510	0.013	0.020
D	4.700	5.100	0.185	0.201
D1	3.202	3.402	0.126	0.134
e	1.270 BASIC		0.050 BASIC	
θ	0°	8°	0°	8°