



DW8560

AC Input High-Voltage Linear LED Driver

Preliminary

Ver. 0.3

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1. General Description

DW8560 is an integrated AC input high-voltage LED driver for direct line operation. 220V AC line voltage is rectified by Bridge Rectifier, and supply for LED and DW8560. During one rectified line voltage cycle, 4 HVLED segments are turned on in proper sequence as the line voltage increases and turned off in reverse sequence as the line voltage decreases. DW8560 setup LED current for every LED segment, which ensures high power factor and low THD. LED current can be setup via an external resistor conveniently. The setup range is 10~50mA. DW8560 regulates the effective LED current and ensures the LED current is constant when VIN varies. DW8560 provides over temperature protection. When temperature inside chip exceeds 145℃, DW8560 limits the maximum current which can help chip cooling.

■ Features

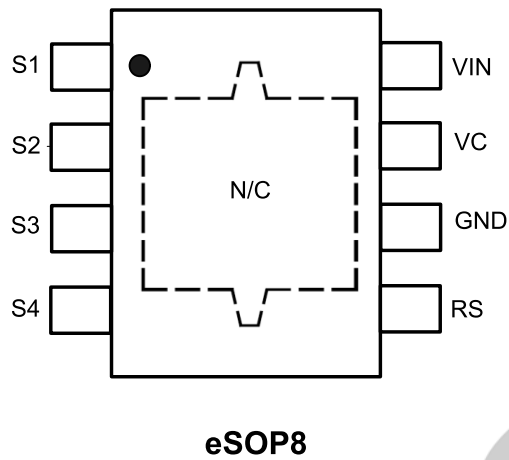
- 50/60Hz, AC input operation
- Only 2 external components
- Integrated 600V and 500V LDNMOSFET
- High power factor and low THD
- Programmable LED current
- Constant LED current control
- Over thermal protection
- eSOP8 package

■ Applications

- Isolated type LED driver applications
- Signage and decorative LED lighting
- General lighting of flat panel displays
- Automotive
- RGB backlighting
- General purpose constant current source
- In/Outdoor Lighting, Street, Roadway, Parking, Construction Lamp

2. Pin Information

■ Pin Placement



■ Pin Description

No.	Pin Name	Description	Note
1	S1	Connect to Cathode of 1 st LED string	
2	S2	Connect to Cathode of 2 nd LED string	
3	S3	Connect to Cathode of 3 rd LED string	
4	S4	Connect to Cathode of 4 th LED string	
5	RS	LED current setting pin	
6	GND	Ground	
7	VC	Current compensation pin	
8	VIN	Power supply for DW8560	
0	NC	Exposed PAD for thermal dissipation	

3. Absolute Maximum Ratings⁽¹⁾

Symbol	Parameter	Ratings
S1	S1 Voltage	600V
S2,S3,S4	S2, S3, S4 Voltage	500V
RS	RS Voltage	-0.3V ~ 6V
θ_{JA}	Package Thermal Resistance ⁽²⁾	50 °C/W
θ_{JC}	Package Thermal Resistance ⁽²⁾	10 °C/W
T _{JOPR}	Junction Operating temperature	-40~+125 °C
T _{STG}	Storage Temperature	-65 ~ 150 °C
T _J	Junction temperature ^{(3),(4)}	150 °C

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; exceeding only one of these values may cause irreversible damage to the integrated circuit.

(2) Measured on JESD51-7, 4-layer PCB

(3) The DW8560 guarantees robust performance from -40°C to 150°C junction temperature. The junction temperature range specification is assured by design, characterization and correlation with statistical process controls.

(4) The DW8560 includes thermal protection that is intended to protect the device in overload conditions. Thermal protection is active when junction temperature exceeds the maximum operating junction temperature. Continuous operation over the specified absolute maximum operating junction temperature may damage the device

4. Recommended Operating Condition

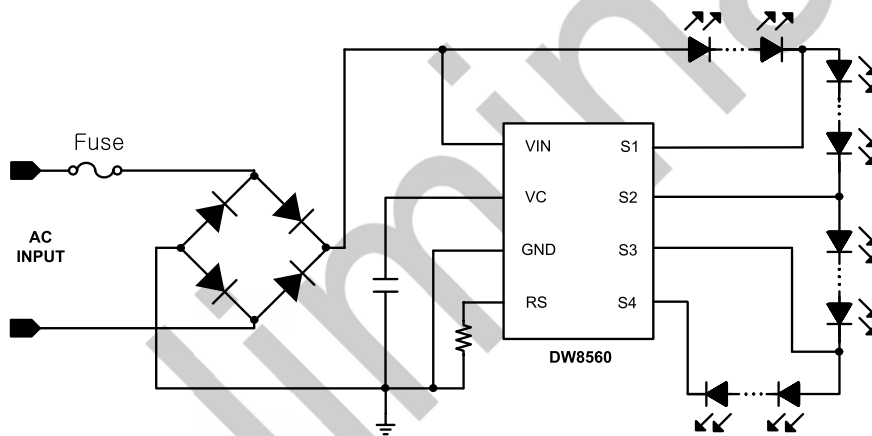
Symbol	Parameter	Min.	Typ.	Max.	Unit
V _{IN}	Supply voltage			264	V _{AC}

5. Electrical Specification

(V_{IN} =220VAC, typical values are at T_A =+25°C, unless otherwise specified.)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
V_{IN} Start Up Voltage Threshold	V_{IN_ON}		10	12	15	V
V_{IN} Start Up Voltage Hysteresis	V_{IN_HYS}			2		V
V_{IN} Operation Current	I_{IN}		120	200	280	uA
Accuracy of LED Current Setup		RS=10R		±5		%
LED Peak Current Limit	I_{LMT_P}	RS=10R		100		mA
Thermal Regulation Threshold	OTP	RS=10R		135		°C

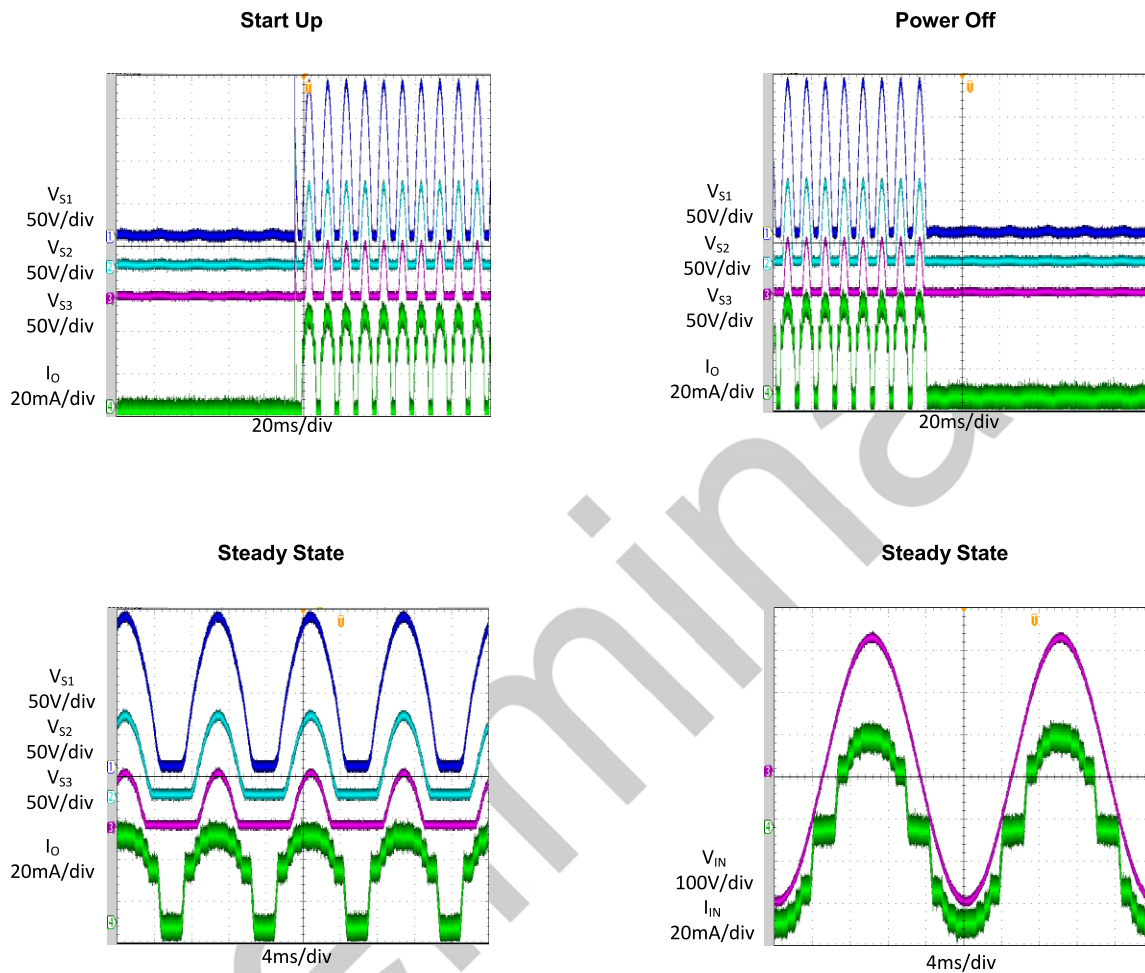
6. Typical Application Circuit



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7. Typical Operating Characteristics

($V_{IN}=220V_{AC}$, 1st string 39LEDs, 2nd string 25LEDs, 3rd string 12LEDs, 4th string 11LEDs, $I_{OUT}=20mA$, typical values are at $T_A=+25^{\circ}C$, unless otherwise specified.)



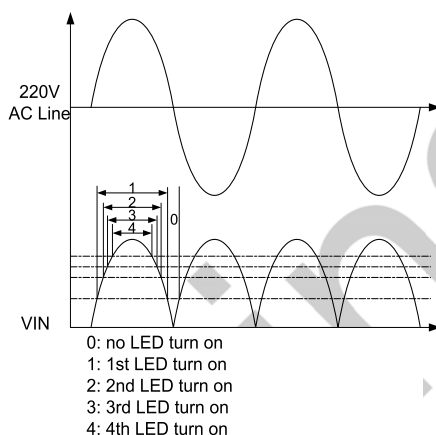
8. Detailed Descriptions

DW8560 is an integrated high-voltage LED driver for direct line operation.

■ Operation Principle

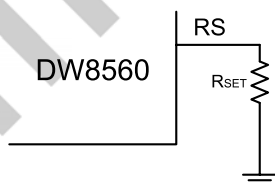
The Input power is the rectified voltage from 220V AC line by bridge rectifier. When VIN is higher than the forward voltage of the 1st LED string, DW8560 is able to detect it and turn on the 1st LDNMOSFET to lighten 1st LED string. When VIN keeps increasing and exceeds the total forward voltage of the 1st and 2nd LED strings, DW8560 turns on the 2nd LDNMOSFET to lighten the 1st and 2nd LED strings. In the same way, all LED strings are lightened as VIN increases.

During VIN decrease, DW8560 shuts down the LDNMOSFET as the reverse sequence.



■ LED Current Setting

DW8560 only need one external resistor between RS PIN to GND to setup the average LED current.



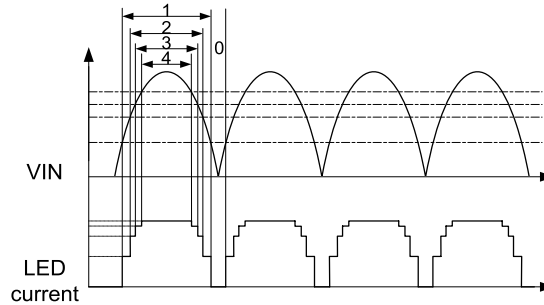
The LED current can be calculated as:

$$I_{LED_E} = 200/R_S \text{ (mA)}$$

8.1. Detailed Descriptions

■ Power Factor Correction

DW8560 sets different current for every operation state during one VIN cycle to ensure the LED current follows the phase of input voltage, which provides high Power Factor (PF) and low Total Harmonic Distortion (THD).



The current ratio of every operation state is setup as following:

Enabled LED string	Current Setup
1 st	8X
1 st & 2 nd	10X
1 st & 2 nd & 3 rd	11X
All	12X

■ Constant Current Control

Once the quantity of LED is fixed, the variation of input line voltage influences the average LED current. DW8560 regulates the average LED current. When the current varies due to the variation of input line voltage, DW8560 regulates the reference current and ensures that the average LED current is constant.

■ Over Thermal Protection

DW8560 detects the junction temperature. When the temperature exceeds 140°C, DW8560 can reduce the LED current to decrease chip temperature.

■ Design Guideline

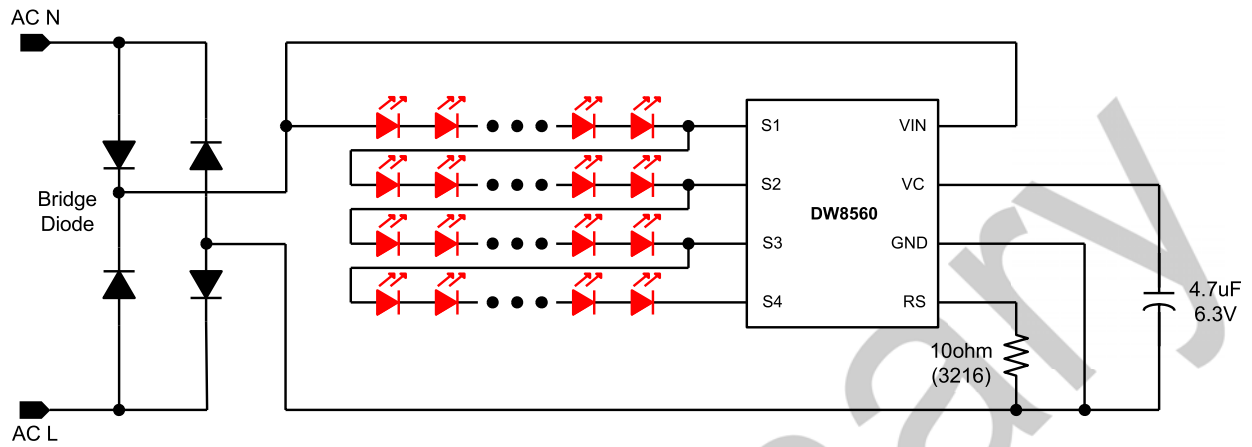
- When For improving efficiency, the 4 LED strings should be designed as following:

LED String	Forward voltage
1 st LED string	162V
2 nd LED string	36V
3 rd LED string	36V
4 th LED string	18V

- The LED connection wire on PCB or Aluminum substrate should be as short as possible to avoid noise disturb by LC coupling.

9. Application Reference

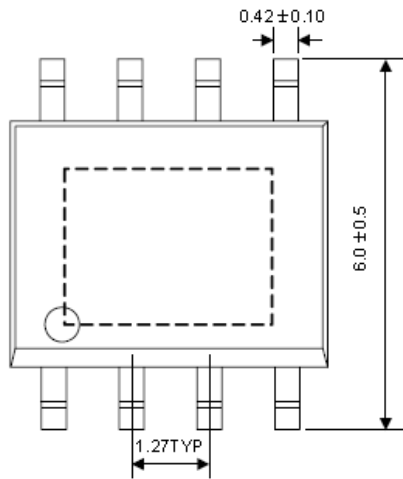
VIN: 220VAC
IOUT: 20mA



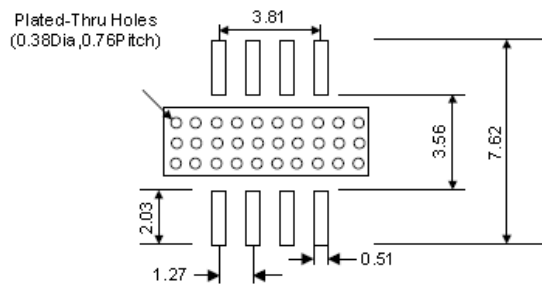
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10. Package Dimension

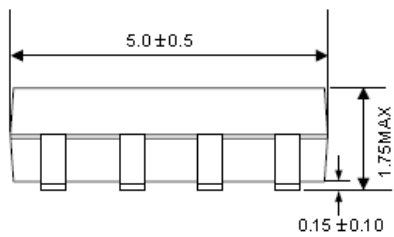
Package Name : eSOP – 8
 Package Size : 5.0mm * 6.0mm, Thickness : 1.75mm
 Pin Pitch : 1.27mm



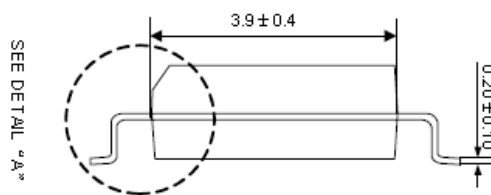
TOP VIEW



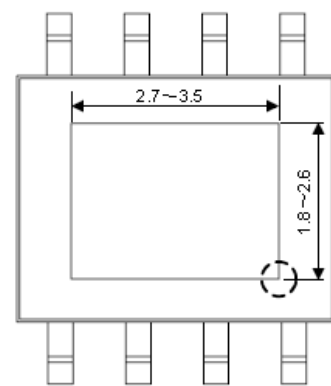
RECOMMENDED LAND PATTERN



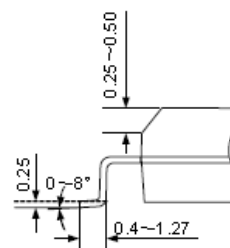
FRONT VIEW



SIDE VIEW



BOTTOM VIEW



DETAIL "A"