



TRIAC Dimmable Offline LED Driver

General Description

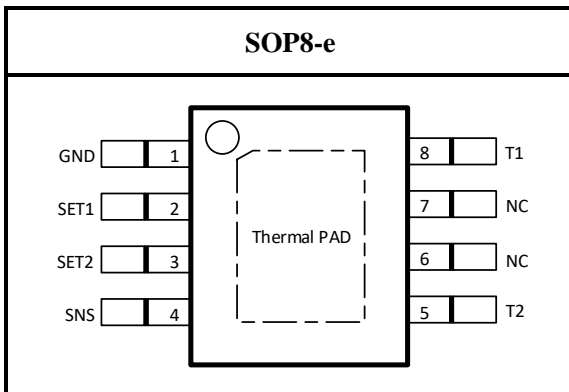
The VAS1106A is a constant current driver designed to be compatible with TRIAC dimmers. A string of series/parallel LEDs is tapped at the Drain of integrated high voltage switch. The LED current is programmable and kept constant by a current source.

The VAS1106A includes a bleeder circuit to ensure proper TRIAC operation by allowing current flow while the line voltage is low to enable proper firing of the dimmer.

The device has an input voltage detecting circuit improves PSRR performance when AC line voltage varies.

VAS1106A is available in a SOP8-e package.

Pin Configuration



Features

- Fit TRIAC Dimming
- Flicker-less Application
- Parallel for High Power
- Adjustable output current 5~90mA(T2 terminal)
- Adjustable bleed current 0~50mA(T1 terminal)
- Obtain 140mA current capability total by parallels T1 and T2 terminal together
- Constant current $\pm 5\%$ accuracy
- Temperature Compensation
- Low conducted EMI without filters
- SOP8-e package

Application

- LED Lighting

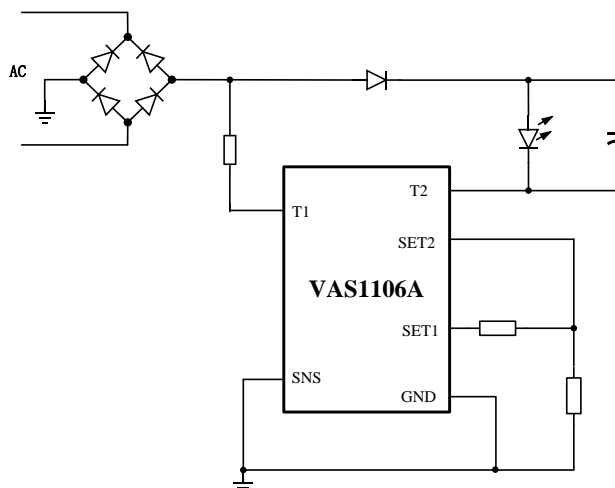
Ordering Information

Order Number	Package Type	Temp. Range
VAS1106AID08E	SOP8-e	-40 °C to 85°C

I: Industry, -40~85°C
08: Pin Number

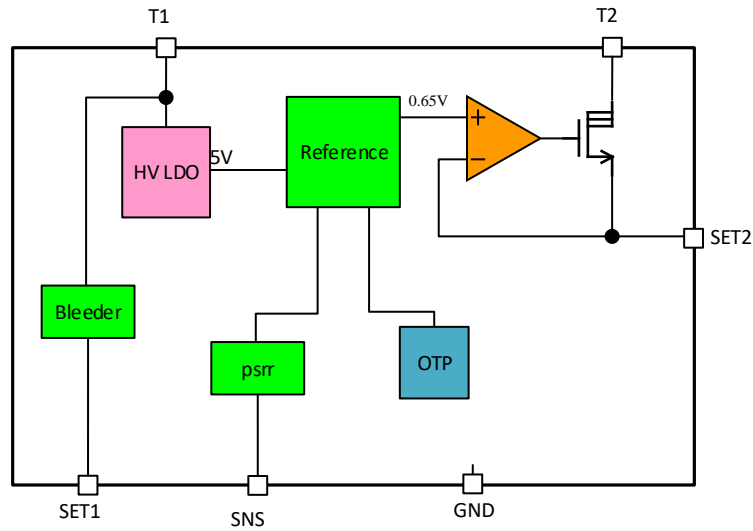
D: SOP
E: ROHS

Typical Application Circuit





Block Diagram



PIN Description

PIN NO.	Name	Description
1	GND	Ground
2	SET1	Provide a bleeder current to ensure proper firing of the triac dimmer. $I_{Bleeder} = \frac{V_{SET1}}{R_{SET1} + R_{SET2}}, V_{SET1}=500mV.$
3	SET2	Current set for current regulator, connect a resistor to GND to set the LED current. $I_{LED} = \frac{V_{SET2}}{R_{SET2}}, V_{SET2}=650mV.$ If the IC temperature rise up to 140°C, the SET2 voltage will drop to reduce current. The SET2 voltage will drop down to 200mV
4	SNS	The input voltage sense pin
5	T2	Current regulator outputs. Connect to taps along the LED string
6	NC	No Connection
7	NC	
8	T1	Connect to power line
EP	GND	Thermal PAD must connect to Ground



Absolute Maximum Ratings (Note1)

Parameters	Maximum Ratings
T1~T2 to GND	-0.3V to 500V
SET1,SET2,SNS to GND	-0.3V to 8V
Operating temperature range	-40°C to +85°C
Junction temperature	-40°C to +160°C
Storage temperature range	-65°C to +150°C
ESD human body model	2000V

Note1: Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other condition beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Electrical Characteristics (Note2)

Symbol	Parameter	Condition	SPEC			Unit
			Min.	Typ.	Max.	
VSUP	Input voltage range				500	V
ICC	Quiescent current	VT1=310V		160	300	μA
V _{SET1}	SET1 pin voltage			0.5		V
V _{SET2}	SET2 pin voltage		0.627	0.65	0.683	V
I _{BLEED}	Adjustable bleed current				50	mA
I _{LED}	Adjustable output current		5		90	mA
I _{ACCU}	Current accuracy	VT1=310V		±5		%
T _{SD}	OTP threshold			160		°C
R _{θJA}	Thermal resistance	SOP8-e		85		°C/W

Note 2: Production testing of the device is performed at 25°C. Functional operation of the device and parameters specified over other temperature range, are guaranteed by design, characterization and process control.

Package Thermal Data (Note3)

Order Number	θ _{JC} Thermal Resistance Junction-to-Case	θ _{JA} Thermal Resistance Junction-to-Ambient	P _{DIS} TA=+25°C TJ=+125°C
VAS1106AID08E	40	85°C/W (Note4)	1.1W

Note3: Dominant conduction path via exposed pad.

Note4: Test condition for SOP8-e: Device mounted on FR-4 PCB (51mm * 51mm 2oz cooper, minimum recommended pad layout on top layer and thermal vias to bottom layer ground plane. For better thermal performance, larger



copper pad for heat-sink is needed.

Application Information

1. Set LED Current

The VAS1106A feature a programmable LED current using a resistor R_{SET2} . Use the following equation to calculate the sense resistor:

$$I_{LED} = \frac{0.65V}{R_{SET2}}$$

Change the value of R_{SET} can obtain the required constant current. The chip power consumption is $I_{LED} * V_D$, V_D is LED cathode voltage. In order to get the higher accuracy of the LED output current, a 1% or more high precision and low temperature coefficient resistor is commented.

2. Set Bleeding Current

Bleeder current is to ensure the proper firing of TRIAC dimmer. Resistors R_{SET1} and R_{SET2} are used to set bleeding current by:

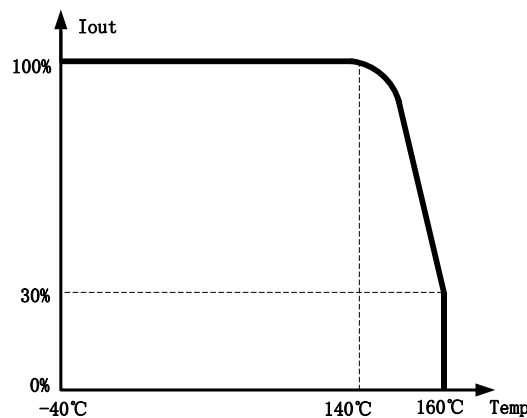
$$I_{Bleeder} = \frac{0.5V}{R_{SET1} + R_{SET2}}$$

Typically values of R_{SET1} & R_{SET2} are as follows:

Vin/Input	R_{SET1}	R_{SET2}
120V/4W	18Ω	10Ω
230V/4.5W	51Ω	18Ω

3. Over-Heating Issue

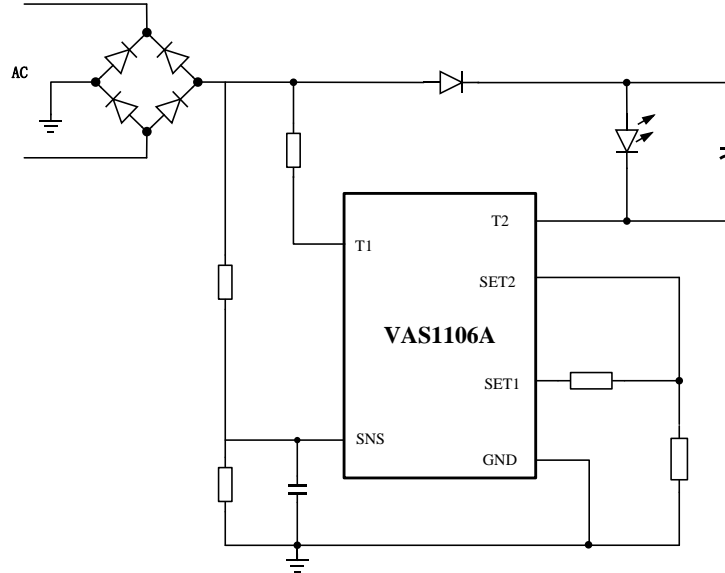
The VAS1106A provide thermal protection features. It reduces the output current when the die temperature rises over 140°C and shuts down the operating when the temperature is over 160°C. Once the temperature dropped to 130°C, VAS1106A re-start to work again.



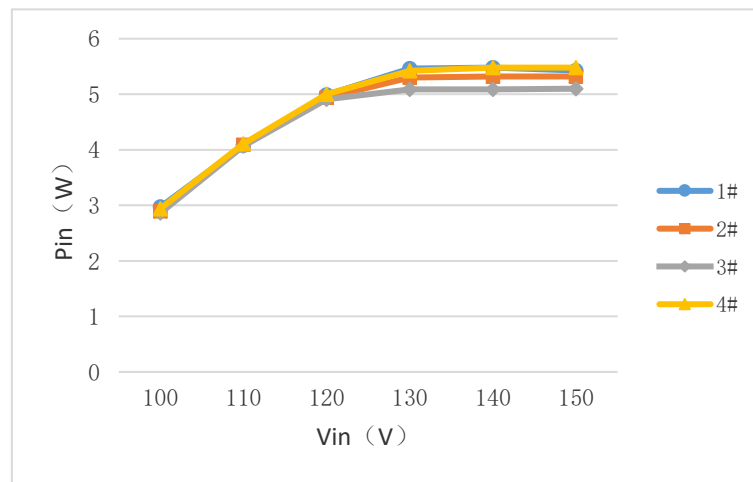
Temp Change Curve

4. Line Regulation Improving Feature

As the line voltage varies, the LED turn on time changes thus affects the system's input power. The VAS1106A has the feature to sense the line voltage by SNS PIN and provide feedback to compensate the power.



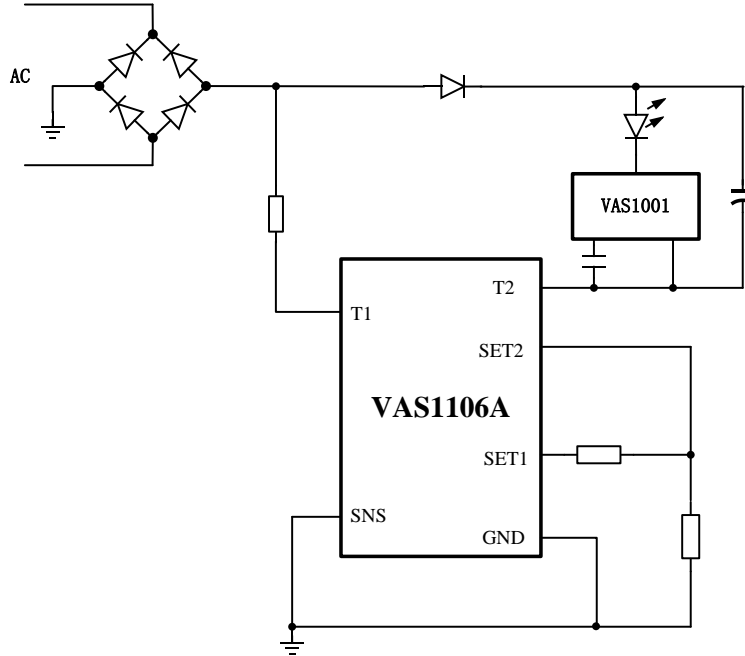
In typical case for a 25% increase on the line voltage of 120V system, this feature provides a compensation that the input power only changes 8%. And less power increase means less over-heating issue. Following picture shows the performance characteristic of the feature.



P_{IN} vs. V_{IN}

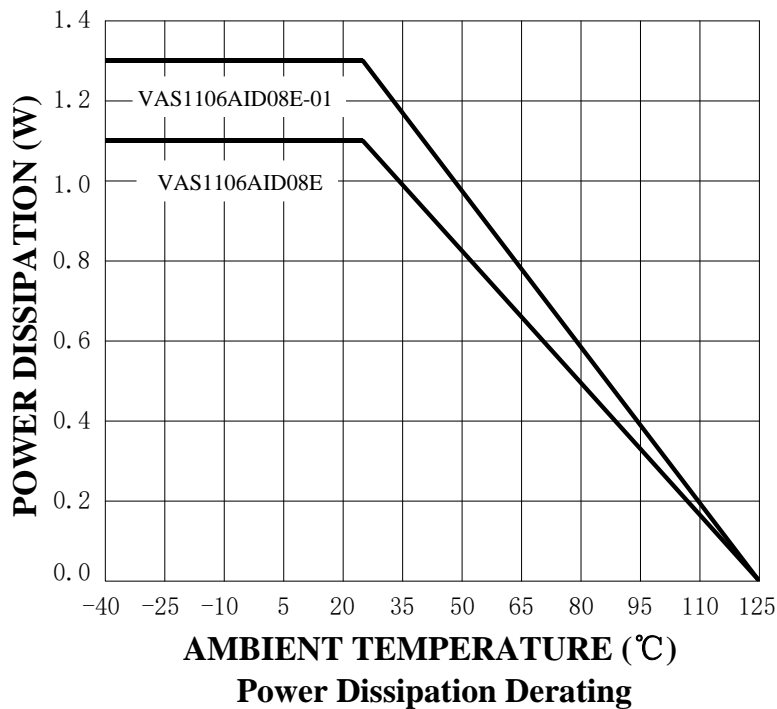
5. Flicker-less Application

VAS1106A provides excellent performance for Flicker-less application with VAS1001. It does not require large value capacitors and minimize total components. It's an ideal solution for space limited applications.



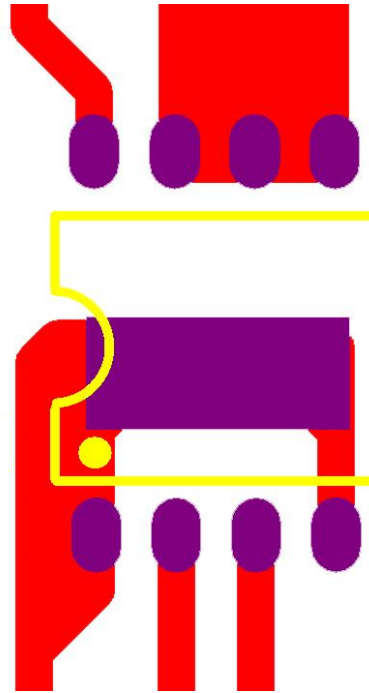
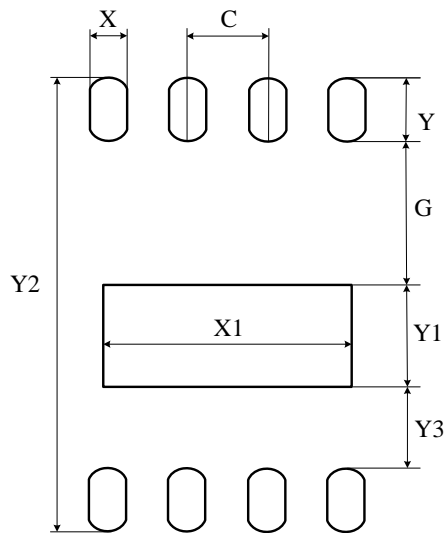
6. Thermal Considerations

The figure below shows how the VAS1106A's power dissipation capability varies with package; these values will vary with PCB size and area of metal associated with the ground plane used for heat sinking. By increasing the area on the top layer the thermal impedance of both packages could be improved.



7. PCB layout

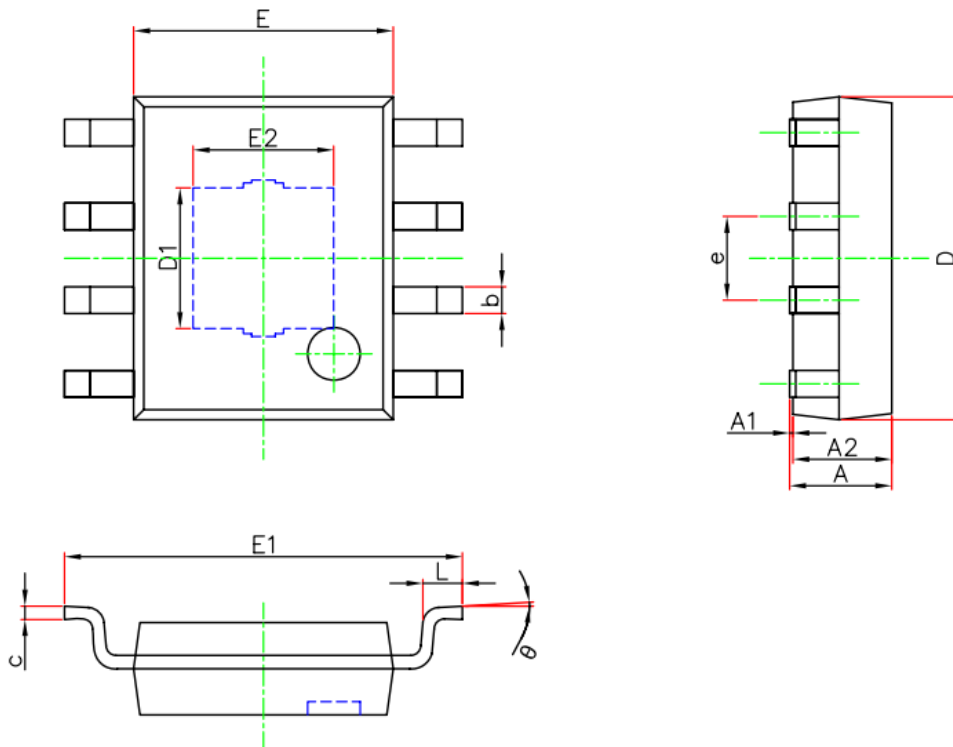
The designed linear LED driver is directly connected to the AC line, therefore the voltage can be up to hundreds of volts. This feature strictly limits the PCB layout. For safety consideration, the footprints of the SOP8-E should be modified. Recommended minimum space of the pad is showing as follows:



Dimensions	Value (in mm)
C	1.25
G	2.225
X	0.6
X1	4
Y	1
Y1	1.6
Y2	7.1
Y3	1.275



Package Information (SOP8-e VAS1106AID08E)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.300	1.700	0.051	0.067
A1	0.000	0.100	0.000	0.004
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
D1	2.034	2.234	0.080	0.088
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	2.034	2.234	0.080	0.088
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°