SM2188EH

Feature

- Patented constant current control technology
- Input voltage： 120Vac/220Vac
- No flicker, can meet the new ERP standard requirements
- Output current deviation between chip and chip: < ±5%
- Meets EMI applications without magnetic components
- Over temperature adjustment function
- Package: ESOP8

Application

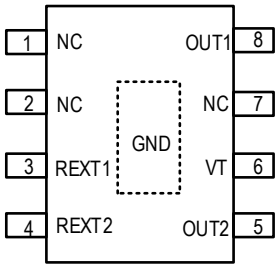
- LED Fluorescent tube
- LED bulb lamp
- Floodlight
- High bay light
- The other LED lighting

Description

SM2188EH is a non-flicker LED linear constant current control chip that can meet the new ERP standard. It has a built-in over-temperature protection function to improve system application reliability. The peripheral can adjust the output current by adjusting the REXT resistance value. At the same time, SM2188EH integrates the input line voltage compensation function. When the input line high voltage is over, the electrolytic charging current is reduced according to the external compensation resistor to meet the new ERP standard.

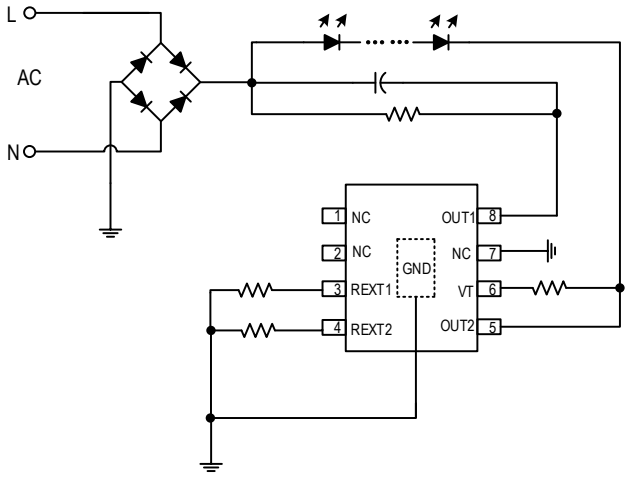
It is mainly used in LED lighting, architectural lighting engineering and other fields. The system has a simple structure, few external components, simple PCB wiring, and low cost.

Pin Diagram



ESOP8

Typical Application



Pin Description

Pin No.	Pin Name	Description
1、2	NC	No connection
3	REXT1	Output current setting port1
4	REXT2	Output current setting port2
5	OUT2	Power input and constant current output port 2
6	VT	Constant power setting port2
7	NC	Connect to ground when applied
8	OUT1	Power input and constant current output port 1
Substrate	GND	Ground

Order Information

Type	Package	Packing		Reel Size
		Tube	Tape	
SM2188EH	ESOP8	100000 pcs/box	4000 pcs/ tape	13 inches

Absolute Maximum Parameter (Note 1)

Unless otherwise stated, T_A=25°C.

Symbol	Description	Range	Unit
V_{OUT1}	OUT1 voltage	-0.5~450	V
V_{OUT2}	OUT2 voltage	-0.5~500	V
V_{REXT}	REXT voltage	-0.5~8	V
V_T	VT voltage	-0.5~8	V
RθJA	PN junction to ambient thermal resistance (Note 2)	65	°C/W
P_D	Power consumption (Note 3)	1.25	W
T_J	Operating junction temperature range	-40~150	°C
T_{STG}	Storage temperature	-55~150	°C
V_{ESD}	HBM ESD	2	KV

Note 1: The maximum output power is limited to chip junction temperature, the maximum limit means that the chip can be damaged beyond the scope of the work. The maximum limit value is the work in the limit parameter range, the device function is normal, but it is not completely guaranteed to meet the individual performance indexes.

Note 2: RθJA measures the flow of water according to the JEDEC JESD51 thermal measurement standard on the single-layer thermal conductivity test board under T_A=25°C.

Note 3: The maximum power consumption is decreased when temperature rising, this depends on T_{JMAX}, RθJA and T_A Maximum allowable power consumption is $P_D = (T_{JMAX}-T_A)/$ RθJA or the lower value of the value given in the limit range.

Electric Operating Parameter (Note 4, 5)

Unless otherwise stated, T_A=25°C.

Symbol	Description	Condition	Range			Unit
			Min.	Typ.	Max.	
V_{OUT1_BV}	OUT1 withstand voltage	-	500	-	-	V
V_{OUT2_BV}	OUT2 withstand voltage	-	500	-	-	V
I_{DD}	Quiescent current	V_{OUT1}=20V， V_{REXT1}=2V	150	220	300	uA
V_{REXT1}	REXT1 voltage	V_{OUT1}=15V，REXT1=30Ω	1.15	1.20	1.25	V
V_{REXT2}	REXT2 voltage	V_{OUT2}=15V，REXT2=30Ω	580	600	620	mV
T_{SC}	Initial point of the negative temperature compensation (Note 6)	-	-	150	-	°C

Note 4: The electrical operating parameters define the DC/AC parameters of the device within the working range and under test conditions that ensure a specific performance indicator. The specification does not guarantee the accuracy of the parameters that are not given the upper and lower limit values, but the typical values reflect the performance of the device.

Note 5: The minimum and maximum parameter range of the datasheet is guaranteed by the test, and the typical value is guaranteed by design, test or statistical analysis.

Note 6: Initial point of the negative temperature compensation is chip internal setting temperature 150 °C.

Function Description

SM2188EH is a LED linear constant current control chip that can meet high PF and no flicker. It has a built-in over-temperature protection function to improve system application reliability. The peripheral can adjust the output current by adjusting the REXT resistance value. At the same time, SM2188EH integrates the input line voltage compensation function. When the input line high voltage is over, the electrolytic charging current is reduced according to the external compensation resistor to meet the new ERP standard.

◆ Output current

OUT1 port output current calculation formula: $I_{OUT1} = \frac{V_{REXT1}}{Rext1} = \frac{1.2V}{Rext(\Omega)}(A)$;

OUT2 port output current calculation formula: $I_{OUT2} = \frac{V_{REXT2}}{Rext2} = \frac{0.6V}{Rext(\Omega)}(A)$。

◆ Input line voltage compensation function

When the system is working normally, when the OUT2 port is turned on, the voltage on the OUT2 port begins to rise, and the voltage of the port connected to VT through the RVT also rises. The chip modulates the output current by detecting the voltage on the VT terminal. The modulation amplitude of the output current is set by the external RVT resistor from VT to OUT2. The relationship is as follows:

$$V_{REXT1}=1.2-12000*\frac{V_{OUT2}-0.7}{R_{VT}}$$

R_{VT}: Line voltage compensation resistance.

◆ Theory of Efficiency Design

The system operating efficiency is:

$$\eta = \frac{P_{LED}}{P_{IN}} = \frac{n * V_{LED} * I_{LED}}{V_{IN} * I_{LED}} = \frac{n * V_{LED}}{V_{IN}}$$

V_{IN} is the input power voltage, V_{LED} is the forward voltage of a single LED, I_{LED} is the LED current. Therefore, the bigger the number (n) of the cascaded LEDs is, the higher the operating efficiency is. During the design of the system, the OUT2 operating voltage of the SM2188EH needs to be adjusted in accordance with the application environment to optimize η.

◆ Heat dissipation management

Internal SM2188EH chips have temperature compensation circuit, In order to avoid the high temperature caused the phenomenon of current dropping, good heat dissipation is needed, and to guarantee that the chip works in reasonable temperature range. Common heat dissipation measures are as follows:

1）The system adopts aluminum plate;

2）Increase the copper covered area of SM2188EH substrate;

3）Enlarge the heat dissipation base of the lamps.

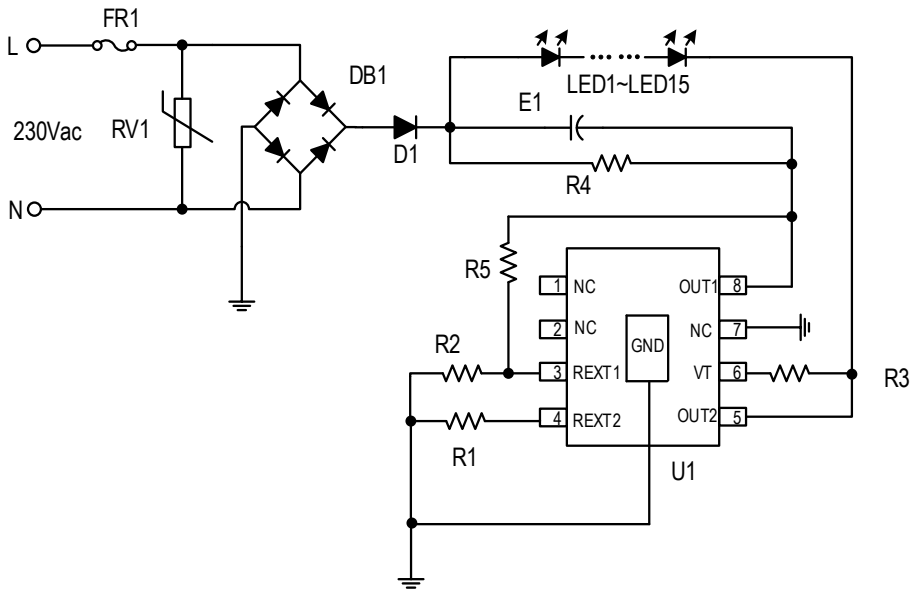
SM2188EH supports chip parallel application scheme. If the system output power is too large and the chip temperature is high, multiple SM2188EH chips can be used in parallel.

◆ Over Temperature

When the interior temperature of the LED lamp is over high, there will be strong light failure and the life span of the LED will be decreased. The SM2188EH integrates temperature compensation. When the internal temperature of the chip reaches 150ºC, the chip will automatically reduce the output current to reduce the internal temperature of the lamp and improve system reliability

Typical Application

◆ SM2188EH Non-flicker application scheme（9W/230Vac）



BOM sheet

Bit No.	Parameter	Bit No.	Parameter
FR1	10R/0.5W Winding resistor	R3	1M/0805
RV1	0806 SV431-101A	R4	1M/1206
DB1	MB6S	R5	10K/1206
D1	E1J	E1	6.8uF/400V
R1	22R/0805	U1	SM2188EH
R2	9.1R/0805	LED1~LED15	18V/60mA

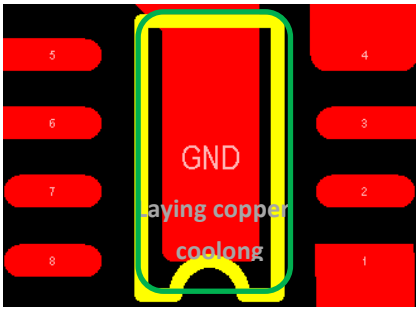
1. Adjust the output current value by changing the resistance value of R1;

2. Adjust the electrolysis charging current by changing the resistance value of R2; R3 is the detection resistance of the system VT pin, and the recommended value is 1M;

3. The voltage drop of the light string is recommended to be 250~260V;

4. To improve system reliability, RV1 is recommended to be retained.

PCB layout Attention



（1） IC substrate and PCB use solder paste process, to guarantee better touch of IC substrate and PCB. Red glue process is prohibited on IC substrate.

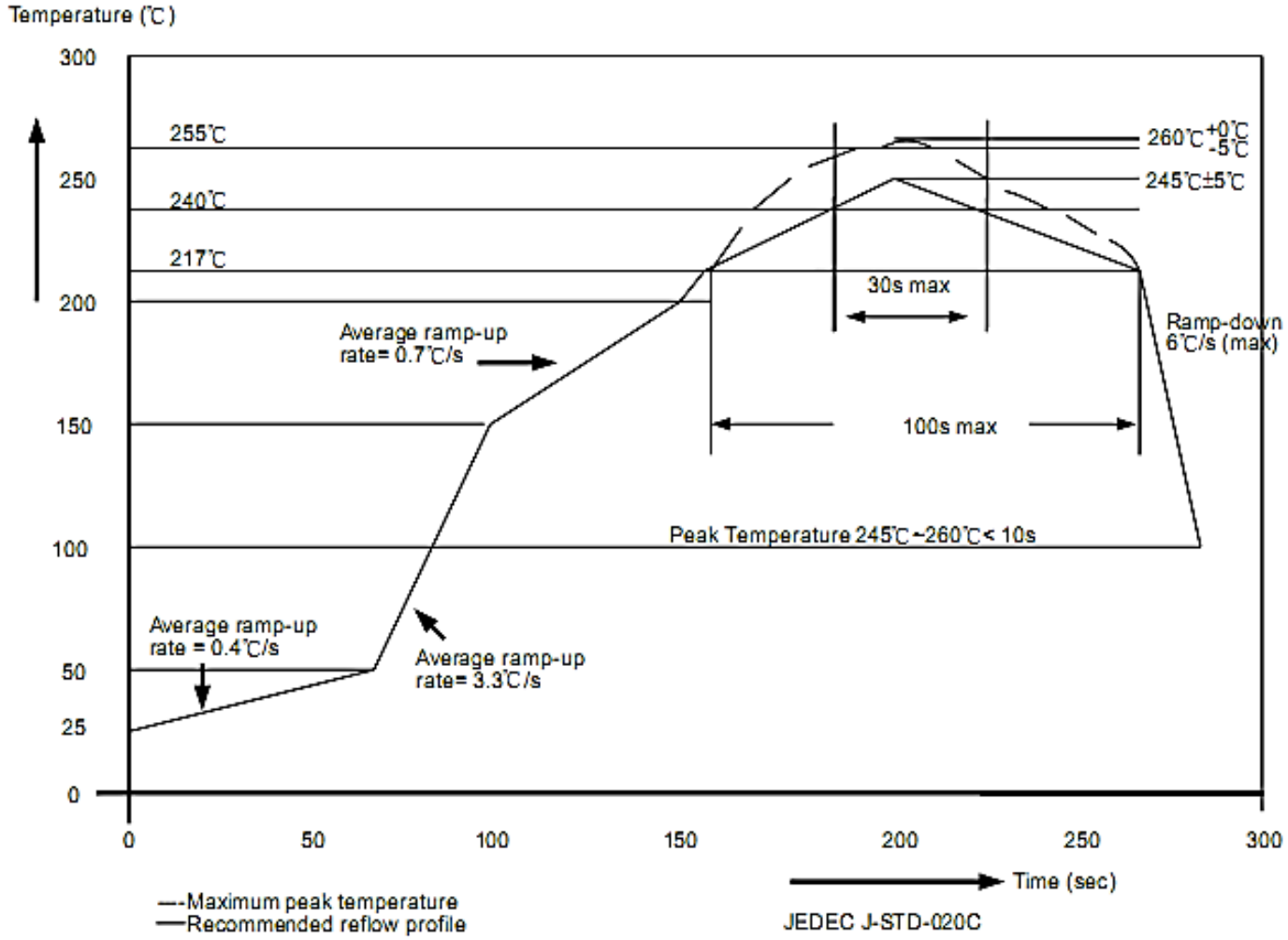
（2） Actual system output power is related to heat dissipation of PCB board and lamp shell, actual application power needs to match heat dissipation condition.

（3） Laying copper on IC substrate for heat dissipation and improve reliability. Copper laying is shown above, suggested substrate bonding pad size is 2.5mm*1.8mm.

（4） Leakage of copper from IC substrate pad must keep at least 0.8mm away from the OUT port.

Encapsulation Soldering Process

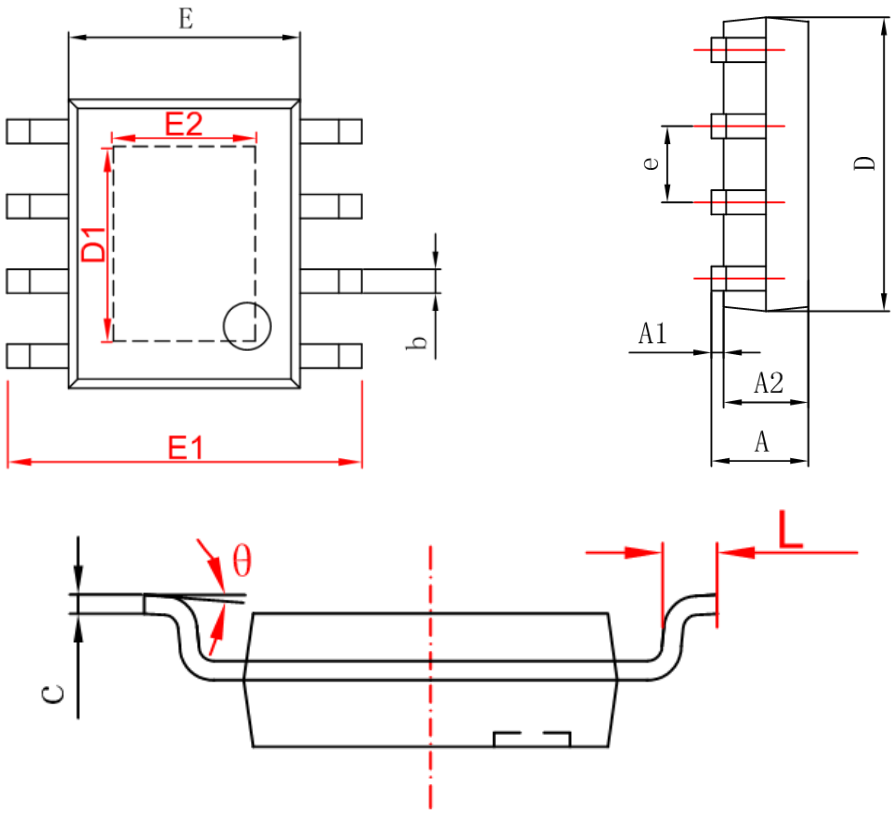
Semiconductors of Sunmoon follow the European RoHs standard, solder temperature in encapsulation soldering process follows J-STD-020 standard.



Encapsulation Thickness	Volume mm^3 < 350	Volume mm^3：350~2000	Volume mm^3 ≥ 2000
<1.6mm	260+0°C	260+0°C	260+0°C
1.6mm~2.5mm	260+0°C	250+0°C	245+0°C
≥2.5mm	250+0°C	245+0°C	245+0°C

Package

ESOP8



Symbol	Min(mm)	Max(mm)
A	1.25	1.95
A1	-	0.1
A2	1.25	1.75
b	0.25	0.7
c	0.1	0.35
D	4.6	5.3
D1	3.12(REF)	
E	3.7	4.2
E1	5.7	6.4
E2	2.34(REF)	
e	1.270(BSC)	
L	0.2	1.5
Θ	0°	10°

Declaration

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