SM2255E

Feature

- Patented constant current technology
  a) VIN port output current is externally adjustable, the maximum current can reach 70mA
  b) OUT1 port output current is externally adjustable, the maximum current can reach 80mA
  c) OUT2 port output current is externally adjustable, the maximum current can reach 100mA
  d) OUT3 and OUT4 port output current is externally adjustable, the maximum current can reach 120mA
  e) Output current error between chip and chip: <±5%
- Input voltage: 120Vac/220Vac
- PF>0.9
- THD<10%
- Over temperature adjustment function
- Overvoltage adjustment function
- Share PCB with LED
- Package: ESOP8

Application

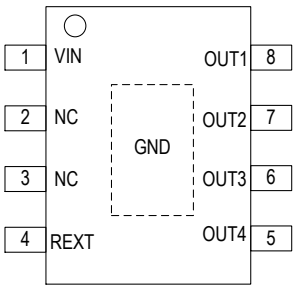
- Projector
- Mining lamp
- Lighting LED lighting
- LED lighting

Description

The SM2255E is a low THD high power factor LED linear constant current driver which integrates over temperature protection function, increasing the reliability of system application. The output current is adjustable through the external Rext.

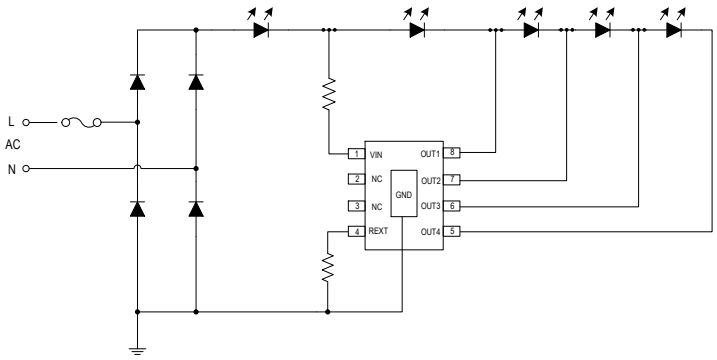
It applied in LED lighting, architectural lighting engineering and other fields. The cost is low with simple structure and fewer peripheral components.

Pin diagram

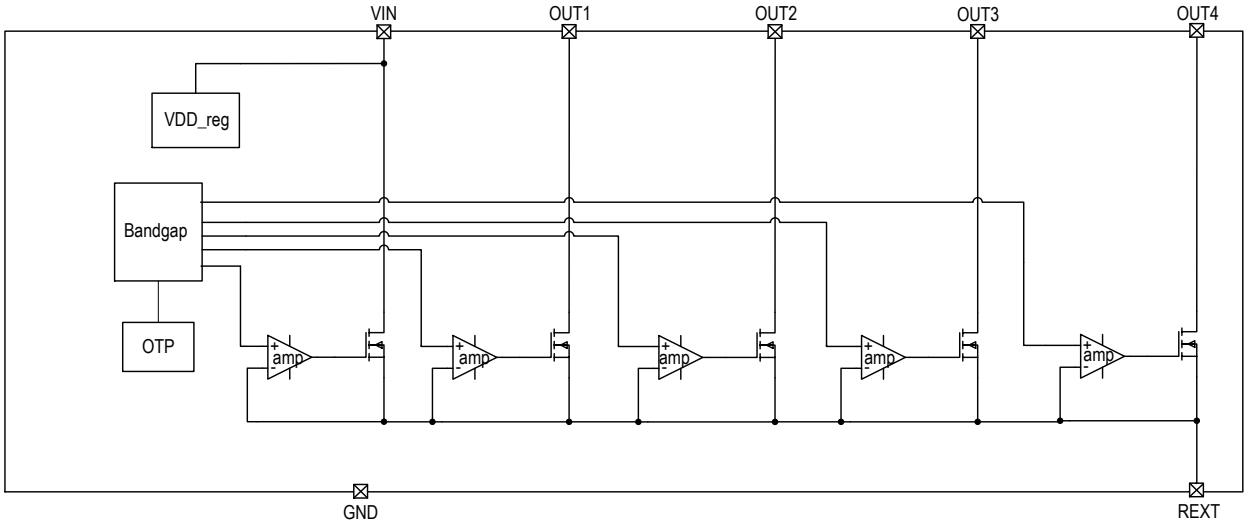


ESOP8

Typical Application



Internal Function Diagram



Pin Description

Pin No.	Pin Name	Pin Description
1	VIN	The power input and constant current output port
2	NC	No connection
3	NC	No connection
4	REXT	Output current setting port
5	OUT4	Constant current output port 4
6	OUT3	Constant current output port 3
7	OUT2	Constant current output port 2
8	OUT1	Constant current output port 1
Substrate	GND	Ground

Order information

Type	Package	Packing		Reel Size
		Tube	Tape	
SM2255E	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_{IN}	VIN voltage	-0.5~600	V
V_{OUT}	OUT voltage	-0.5~600	V
V_{REXT}	REXT 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	-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	Min.	Typ.	Max.	Unit
V_{IN_BV}	VIN withstand voltage	-	600	-	-	V
V_{OUT_BV}	OUT withstand voltage	-	600	-	-	V
V_{IN_MIN}	VIN constant current knee point	I_{VIN}=30mA	-	6.0	-	V
		I_{VIN}=60mA	-	12.0	-	V
V_{OUT1_MIN}	OUT1 constant current knee point	V_{IN}=20V，I_{OUT1}=30mA	-	4.4	-	V
		V_{IN}=20V，I_{OUT1}=60mA	-	11.0	-	V
V_{OUT2_MIN}	OUT2 constant current knee point	V_{IN}=20V，I_{OUT2}=30mA	-	4.2	-	V
		V_{IN}=20V，I_{OUT2}=60mA	-	8.0	-	V
		V_{IN}=20V，I_{OUT2}=90mA	-	17.0	-	V
V_{OUT3_MIN}	OUT3 constant current knee point	V_{IN}=20V，I_{OUT3}=30mA	-	4.0	-	V
		V_{IN}=20V，I_{OUT3}=60mA	-	8.0	-	V
		V_{IN}=20V，I_{OUT3}=90mA	-	13.0	-	V
V_{OUT4_MIN}	OUT4 constant current knee point	V_{IN}=20V，I_{OUT4}=30mA	-	4.0	-	V
		V_{IN}=20V，I_{OUT4}=60mA	-	8.0	-	V
		V_{IN}=20V，I_{OUT4}=90mA	-	13.0	-	V
I_{VIN}	VIN output current	-	5	-	70	mA
I_{OUT1}	OUT1 output current	-	5	-	80	mA
I_{OUT2}	OUT2 output current	-	5	-	100	mA
I_{OUT3}、I_{OUT4}	OUT3、OUT4 output current	-	5	-	120	mA
I_{DD}	Quiescent current	V_{IN}=20V，V_{REXT}=1.1V	0.2	0.25	0.32	mA
V_{REXT_1}	REXT port first voltage	V_{IN}=20V	0.40	0.42	0.44	V
V_{REXT_2}	REXT port second voltage	V_{IN}=20V，V_{OUT1}=10V	0.52	0.55	0.58	V
V_{REXT_3}	REXT port third voltage	V_{IN}=20V，V_{OUT2}=10V	0.68	0.71	0.74	V
V_{REXT_4}	REXT port fourth voltage	V_{IN}=20V，V_{OUT3}=10V	0.82	0.86	0.89	V
V_{REXT_5}	REXT port fifth voltage	V_{IN}=20V，V_{OUT4}=10V	0.89	0.93	0.97	V
D_{IOUT}	IOUT error between chip and chip	I_{OUT}=30mA	-	±5	-	%
T_{SC}	Initial point of the negative temperature compensation (Note 6)	-	-	145	-	°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 145 °C.

Function Description

The SM2255E is a low THD high power factor linear constant current LED driver which operates in segmented automatically switching mode. It integrates and over temperature protection, increasing the reliability of system application.

◆ Output current

The SM2255E has 5 current drive ports and output current each of them output current is adjustable through the external R, $I_{VIN} = V_{VIN}/R$, $I_{OUT} = V_{REXT}/R$ .When switches on various levels turn on step by step, $I_{VIN} = 0.42/R$, $I_{OUT1} = 0.55/R$, $I_{OUT2} = 0.71/R$, $I_{OUT3} = 0.86/R$, $I_{OUT4} = 0.93/R$. System output current is equal to the average of superposition of current ratio corresponding in each port.

◆ Constant current and over temperature curve

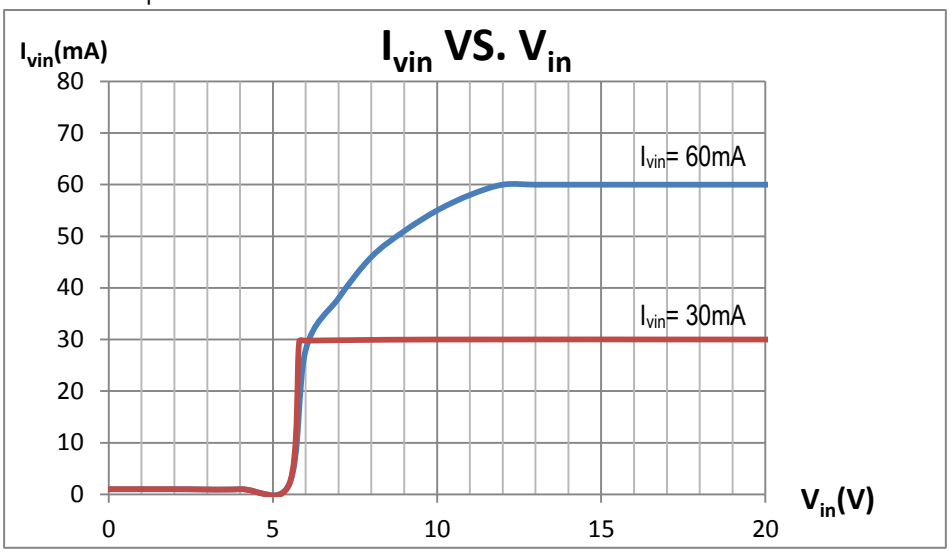


Fig1. SM2255E VIN port constant current curve

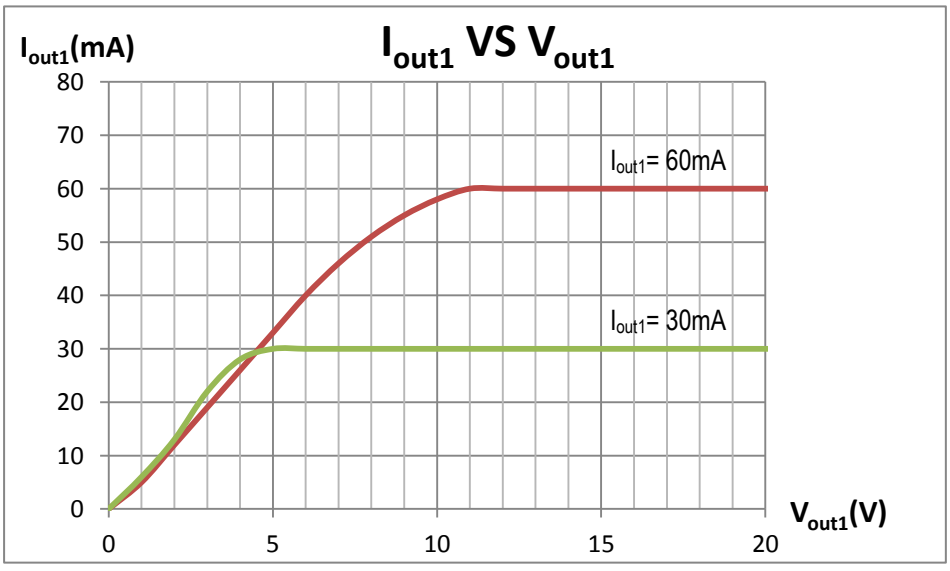


Fig2. SM2255E OUT1 port constant current curve

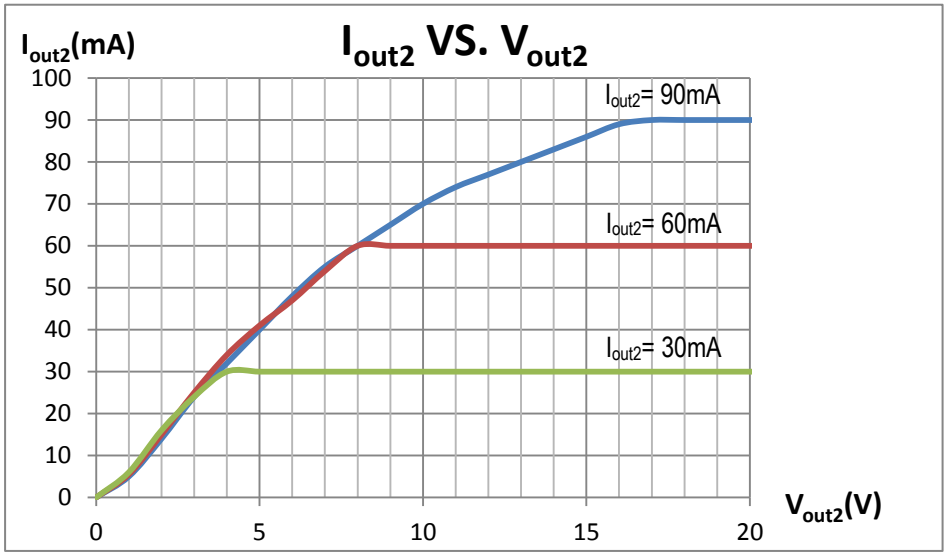


Fig3. SM2255E OUT2 port constant current curve

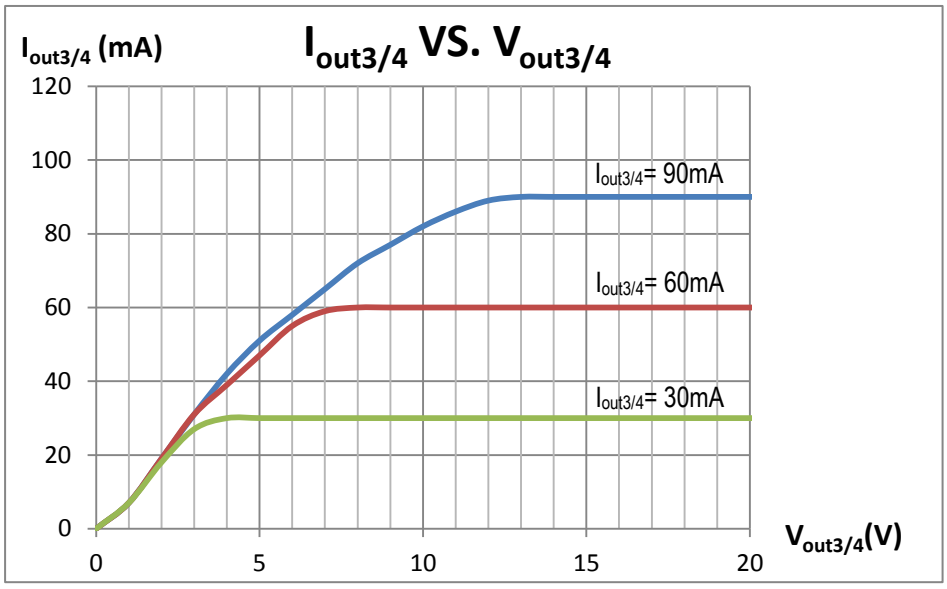


Fig4. SM2255E OUT3/4 port constant current curve

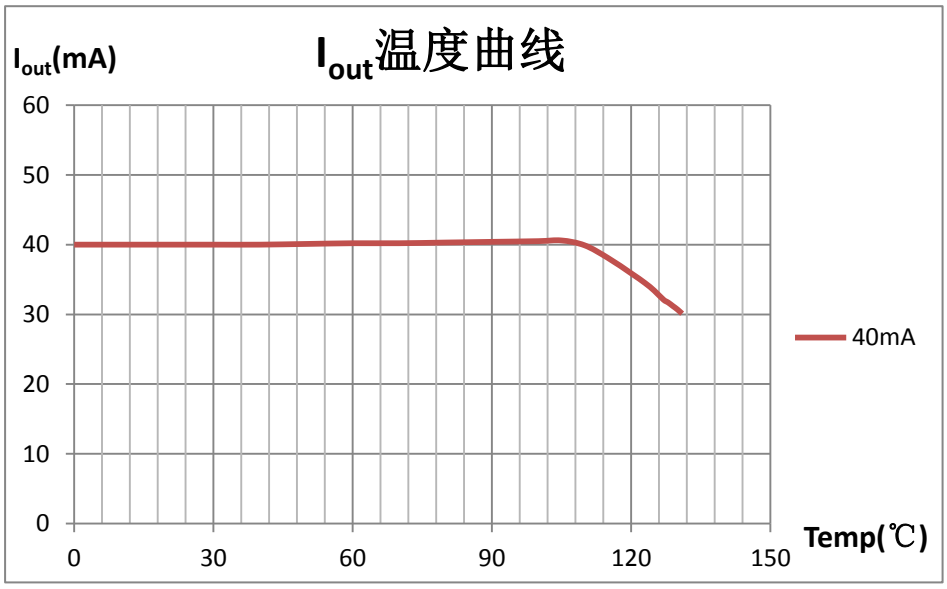


Fig5. SM2255E Output Current Temperature Characteristic (Note7)

Note 7: The chip is soldered to aluminum substrate of 2cm*2cm*1mm.

◆ Output LED lamp bead voltage drop and lamp bead ratio design

SM2255E VIN and each OUT ports' lamp bead voltage drop ratio is recommended to be 2:6:3:2:1(Take 18V lamp bead and 220Vac input system as an example), the system can achieve lower THD, better light efficiency and higher power factor.

◆ System efficiency calculation

The SM2255E system operating efficiency is calculated as follows:

$$\eta = \frac{P_{LED}}{P_{IN}} = \frac{D_1 * V_{LED1} * I_{LED1} + D_2 * V_{LED2} * I_{LED2} + D_3 * V_{LED3} * I_{LED3} + D_4 * V_{LED4} * I_{LED4} + D_5 * V_{LED5} * I_{LED5}}{P_{IN}}$$

D1, D2, D3, D4, and D5 are the duty cycles of VIN, OUT1, OUT2, OUT3, and OUT4, respectively, during the single-wire period.

ILED1、ILED2、ILED3、ILED4、ILED5 are the constant output current when VIN、OUT1、OUT2、OUT3、OUT4 are turned on, respectively.

VLED1、VLED2、VLED3、VLED4、VLED5 are the lamp voltages when VIN、OUT1、OUT2、OUT3、OUT4 are turned on, respectively.

◆ Heat dissipation management

Internal SM2255E 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 SM2255E substrate;

3）Enlarge the heat dissipation base of the lamps.

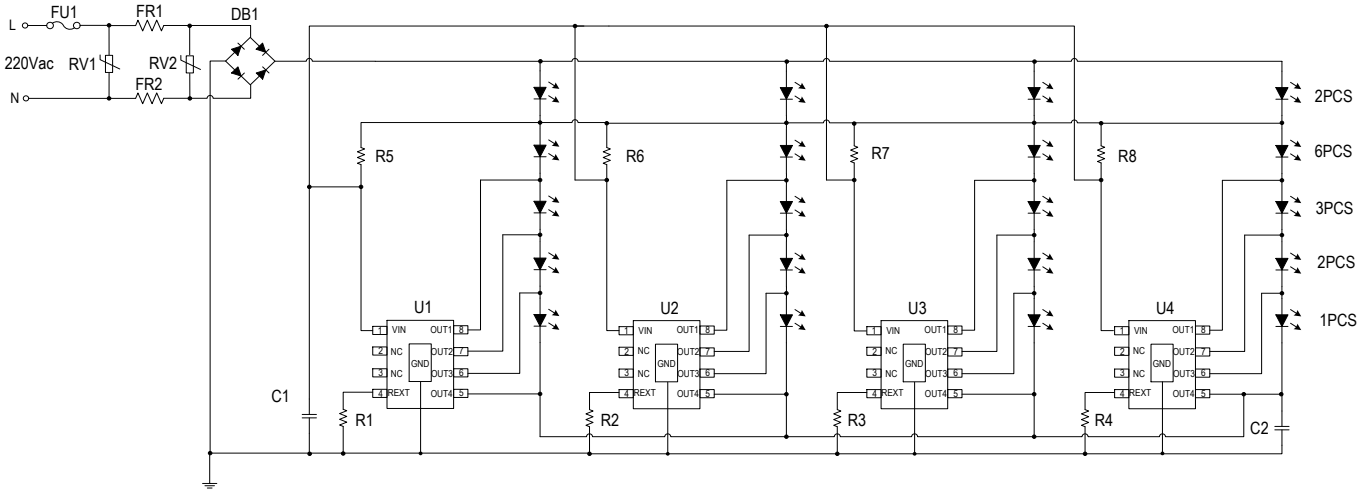
SM2255E support chip parallel application scheme. If the system output power is too large, resulting in high chip temperature, multiple SM2255E chips parallel application can be used.

◆ Over temperature adjustment function

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 SM2255E integrates temperature compensation, when the interior of the chip exceeds 145ºC, the output current will be decreased automatically to lower down the interior temperature of the LED.

Typical Application

◆ SM2255E typical application(50W)

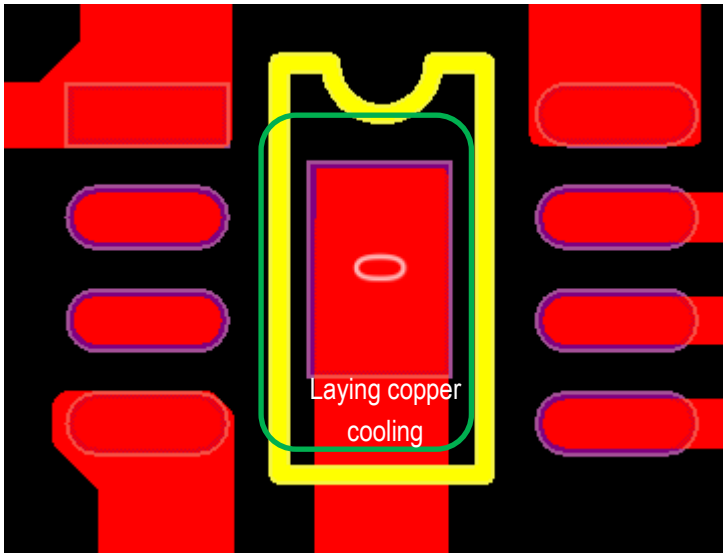


BOM sheet

Bit No.	Parameter	Bit No.	Parameter
FU1	3A/250V	R5、R6、R7、R8	1.2K/1206
FR1、FR2	2.2R/1W winding resistor	U1、U2、U3、U4	SM2255E
DB1	DB107S	C1、C2	10nF/1KV
RV1、RV2	10D471	LED1~LED56	18V/60mA
R1、R2、R3、R4	13R/0805		

- ◆ The LED string voltage is recommended to be controlled between 230V and 250V to optimize system.
- ◆ R5、R6、R7、R8 value 1.2K, can be adjusted according to the actual situation, optimize the THD.
- ◆ Output current is adjusted by R1, R2, R3 and R4s' value.
- ◆ In order to improve system reliability, RV1 and RV2 are suggested to reserve.
- ◆ C1 and C2 are system withstanding high voltage reliability devices.

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.

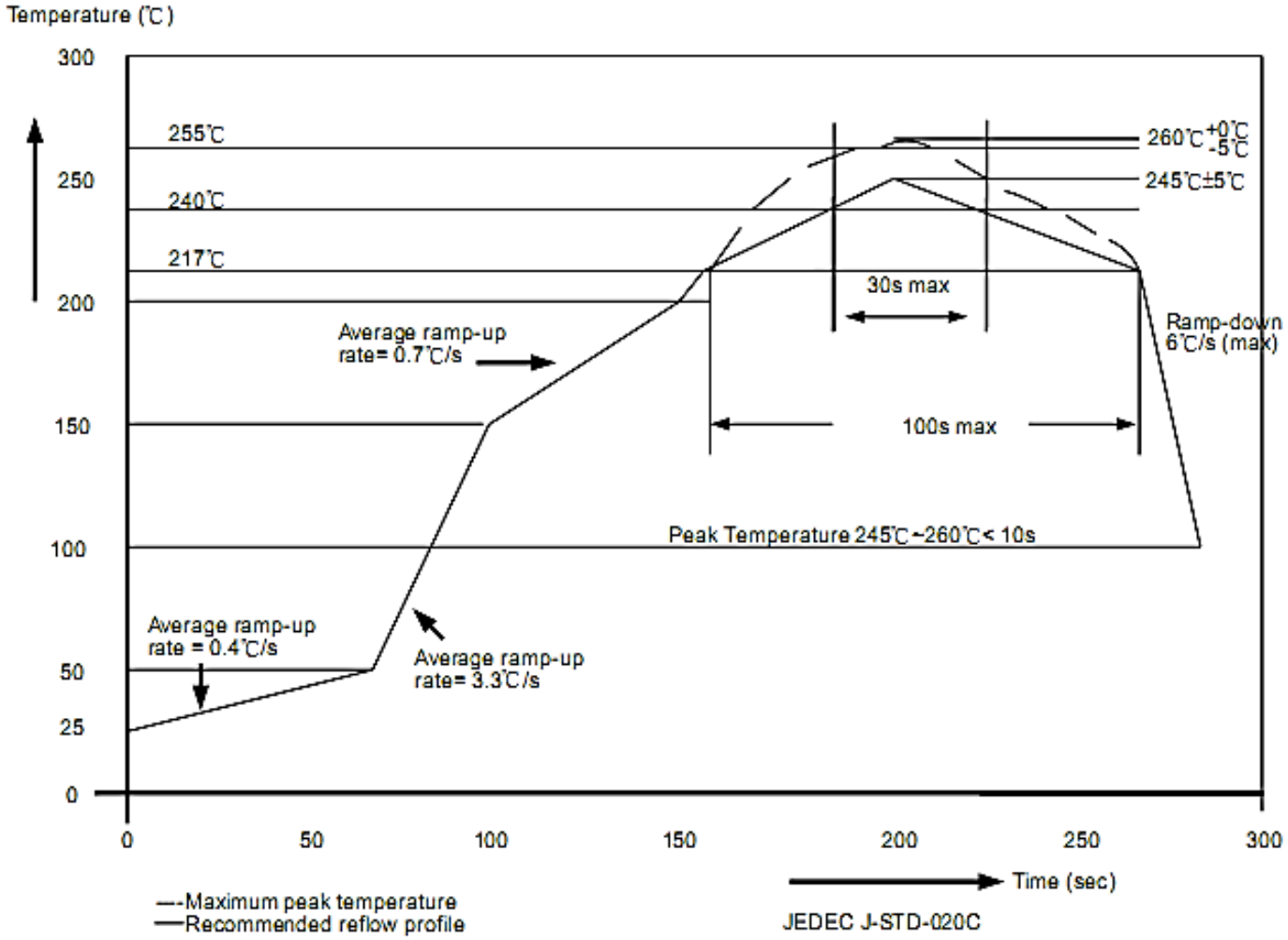
（2） Actual system output power is related to heat dissipation of PCB board and lamp shell, actual application power needs to match heat dissipation condition.

（3） Laying copper on IC substrate for heat dissipation and improve reliability. Copper laying is shown above, suggested substrate bonding pad size is 2.6mm*4.6mm.

（4） Leakage of copper from IC substrate pad must keep at least 1mm away from the VIN port and at least 0.6mm away from the OUT port.

Encapsulation Soldering Process

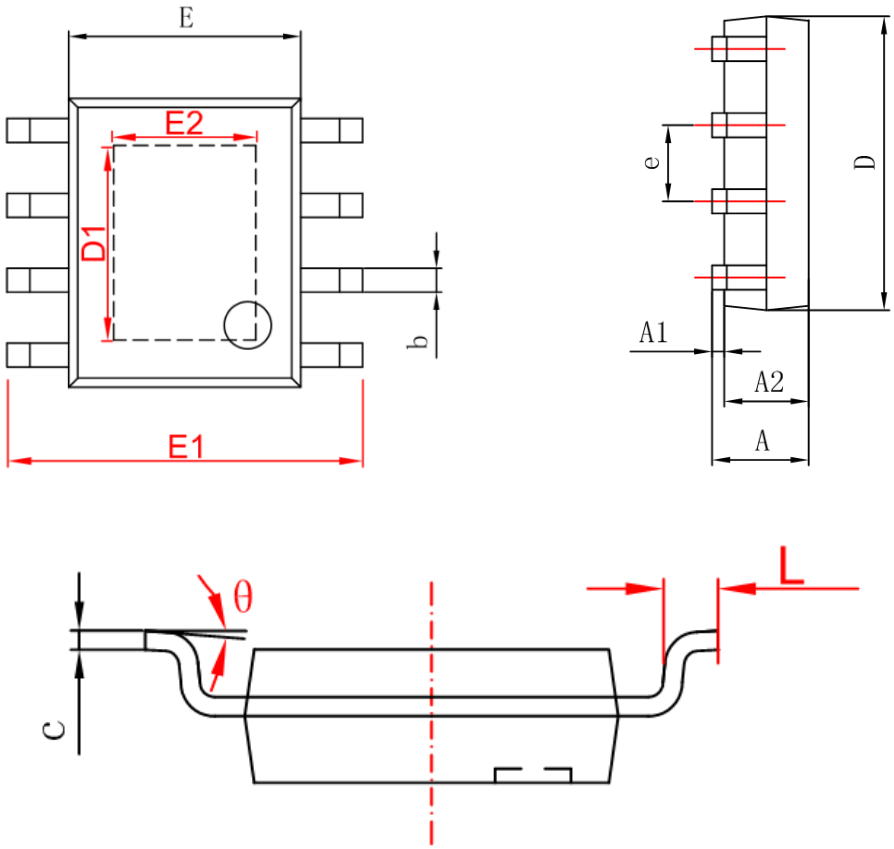
Semiconductors of Sunmoon follow the European RoHs standard, solder temperature in encapsulation soldering process follows J-STD-020 standard.



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°

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