SM2253EKD

Feature

- Patented constant current control technology
- Input voltage: 120Vac/220Vac
- Output current bias between ICs <±5%
- 700V high-voltage MOS tube, can pass 650V lightning strike without any protection device
- Multi-chip parallel application eliminates the need for 0R jumper resistors
- Multi-lamp parallel without oscillation
- PF>0.95, THD<20%
- Extended application can meet fractional harmonics IEC61000-3-2 (Class C)
- No magnetic components for EMI applications
- With over temperature adjustment
- With constant power regulation
- Package: ESOP8

Application

- Projection lamp
- Mining lamp
- LED lamp

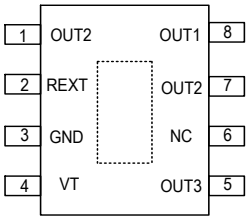
Description

SM2253EKD is a three-segment LED linear constant current control chip with high power factor. It integrates 700V high voltage MOSFET, and adopts unique and innovative device process technology, with superior resistance to avalanche breakdown and surge. It can pass 650V lightning surge test when no protection device in the periphery, and built-in over-temperature protection function to improve system application reliability. The output current can be adjusted by adjusting the REXT on the periphery. At the same time, the SM2253EKD integrates the input line voltage compensation function. When the input line voltage is too high, SM2253EKD will reduce the output current according to the external compensation resistor to ensure that the input power does not change with the line voltage.

It internally optimizes the wiring and facilitates routing when multiple chips are connected in parallel, saving jumper resistance. The SM2253EKD expands the application to meet the fractional harmonic requirements.

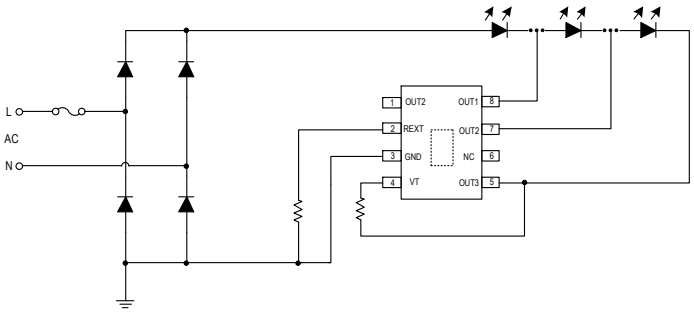
It is mainly used in the fields of LED lighting, architectural lighting engineering, etc. The system structure is simple, the peripheral components are few, the PCB traces are simple, and the solution cost is low.

Pin Diagram

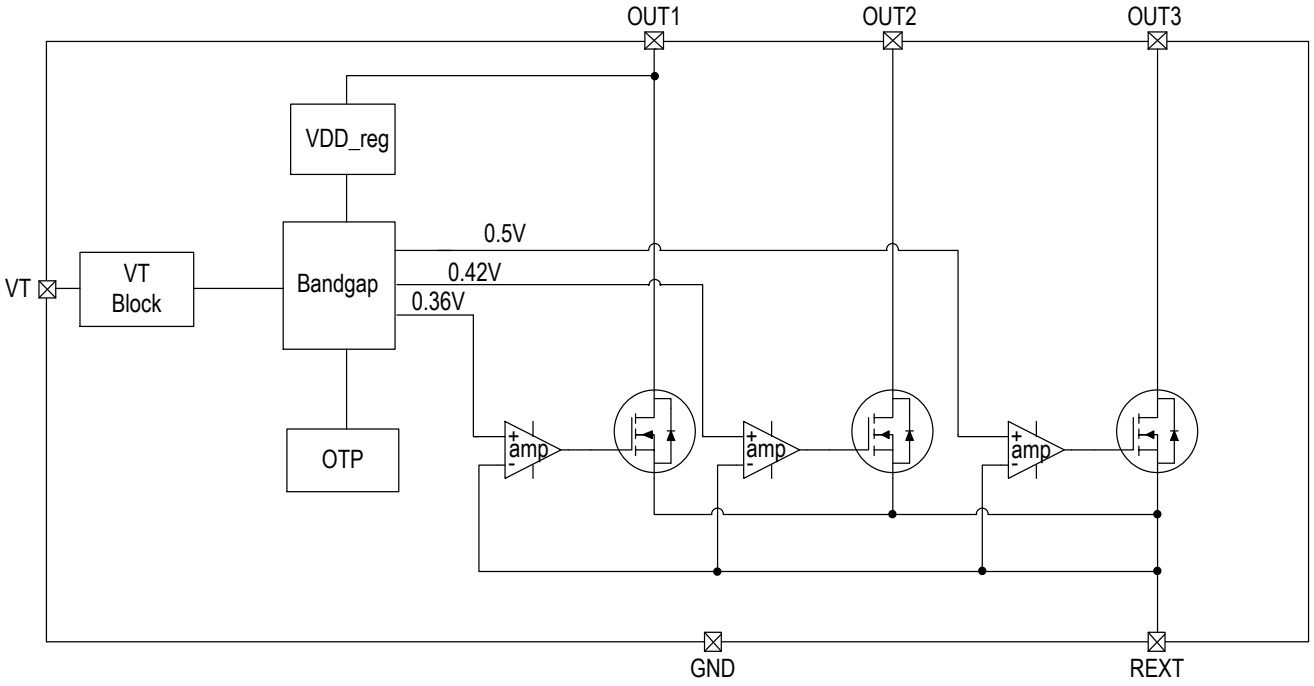


ESOP8

Typical Application



Internal Function Diagram



Pin Description

Pin No.	Pin Name	Pin Description
1、7	OUT2	Constant current output port 2
2	REXT	Output current setting port
3	GND	Ground
4	VT	Constant power setting port
5	OUT3	Constant current output port 3
8	OUT1	Power supply and constant current output port 2
6	NC	No connection
Substrate	NC	Connect to GND in application

Order Information

Type	Package	Packing		Reel Size
		Tube	Tape	
SM2253EKD	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_{OUT}	OUT voltage	-0.5~700	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	-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_{OUT_BV}	OUT withstand voltage	-	700	-	-	V
I_{DD}	Quiescent current	V_{OUT1}=15V，V_{REXT}=2V	0.22	0.30	0.38	mA
V_{REXT_1}	REXT port first voltage	V_{OUT1}=15V，REXT=30Ω	0.342	0.360	0.378	V
V_{REXT_2}	REXT port second voltage	V_{OUT1}=15V，V_{OUT2}=10V REXT=30Ω	0.400	0.420	0.440	V
V_{REXT_3}	REXT port third voltage	V_{OUT1}=15V，V_{OUT3}=10V REXT=30Ω	0.475	0.500	0.525	V
T_{SC}	Initial point of the negative temperature compensation (Note 6)	-	-	130	-	°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 set temperature 130°C.

Function Description

The SM2253EKD is a three-segment high power factor LED linear constant current control chip that operates in a segmented automatic switching mode. The chip integrates constant power and over-temperature protection functions to improve system application reliability.

◆ Output current

The SM2253EKD has three current drive ports, and the output current of each port is adjusted by an external resistor R. The output currents of each switch are turned on as follows: $I_{OUT1} = 0.36/R$, $I_{OUT2} = 0.42/R$, $I_{OUT3} = 0.5/R$, The system output current is equal to the effective value after the current is superimposed on each port.

◆ Input line voltage compensation function

When the system works normally, when the LED of the OUT3 port is turned on, the voltage of the OUT3 port starts to rise, and the voltage of the port connected to the VT through the RVT also rises. The chip modulates the output current by detecting the voltage level of the VT terminal, and the system enters the constant power modulation. The modulation amplitude of the output current is set by the external VT to the RVT resistor of OUT3. The relationship is as follows:

$$V_{REXT3} = 0.5 - 1278 * \frac{V_{OUT3} - 0.7}{R_{VT}}$$

R_{VT}: line voltage compensation resistor.

◆ Output LED lamp bead drop and lamp bead ratio design

It is recommended that the SM2253EKD OUT1~OUT3 port lamp bead voltage drop ratio is 8:3:3 (using 18V lamp bead, 220Vac input system as an example), which can make the system get lower THD, better light efficiency and higher power factor.

◆ System efficiency calculation

The system operating efficiency of the SM2253EKD is calculated as follows:

$$\eta \approx \frac{P_{LED}}{P_{IN}} \approx \frac{D_1 * V_{LED1} * I_{LED1} + D_2 * V_{LED2} * I_{LED2} + D_3 * V_{LED3} * I_{LED3}}{P_{IN}}$$

D1, D2, and D3 are duty cycles of ON1, OUT2, and OUT3, respectively, during the single-wire period.

I_{LED1}, I_{LED2}, and I_{LED3} are constant current output currents when OUT1, OUT2, and OUT3 are turned on, respectively.

V_{LED1}, V_{LED2}, and V_{LED3} are the lamp voltages when OUT1, OUT2, and OUT3 are turned on, respectively.

◆ Heat dissipation measures

The SM2253EKD has internal temperature compensation circuit, to avoid lower current under high temperature, the system uses excellent heat dissipation process. It guarantees the chip operates in proper temperature range, common heat dissipation measures are shown below:

1）The system uses aluminum substrate.

2）Increase the copper covered area of SM2396EK substrate;

3）Enlarge heat dissipation base of the lamps.

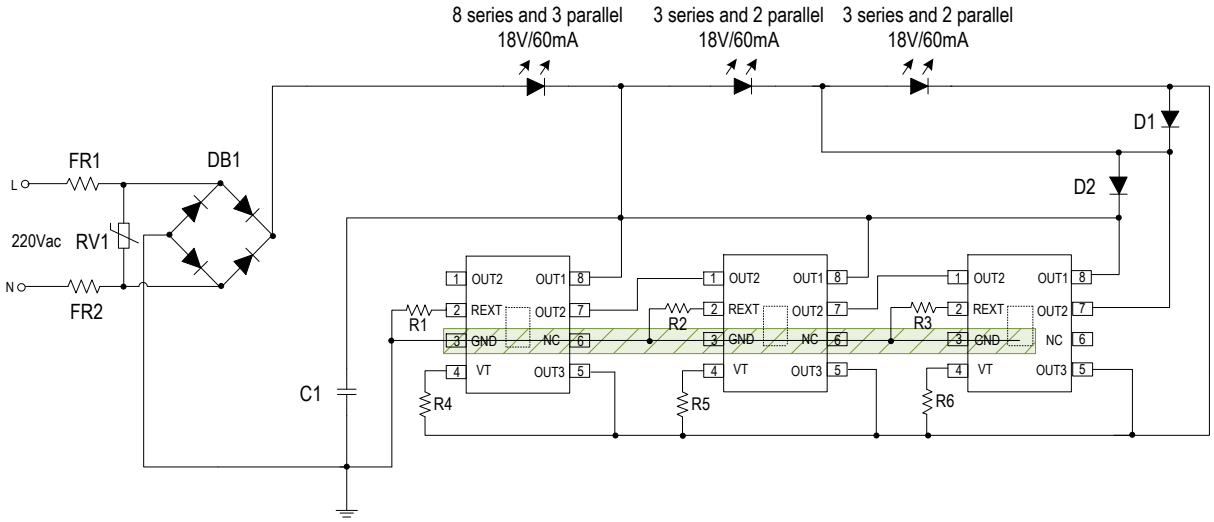
The SM2253EKD supports chip parallel applications. If the system output power is too high and the chip temperature is high, multiple SM2253EKD chips can be used in parallel.

◆ Over temperature adjustment

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 SM2253EKD integrates temperature compensation, when the interior of the chip exceeds 130ºC, the output current will be decreased automatically to lower down the interior temperature of the LED and improve system reliability.

Typical Application

◆ SM2253EKD projection lamp application（30W）

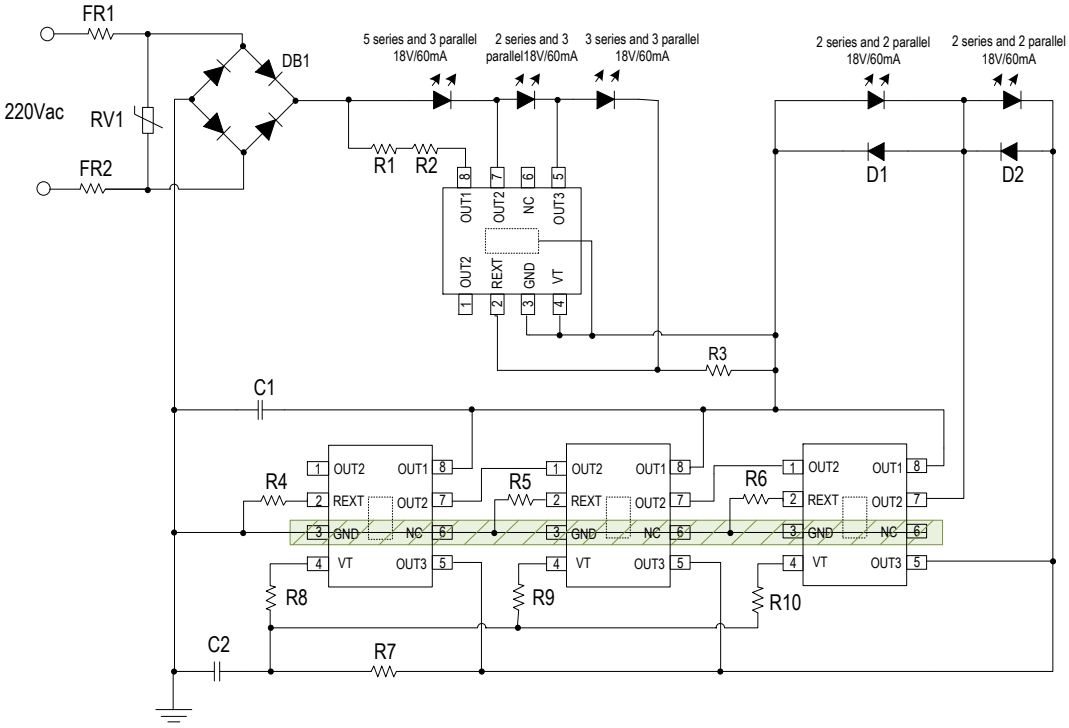


BOM sheet

Bit No.	Parameter	Bit No.	Parameter
FR1、FR2	10R/1W winding resistor	D1、D2	E1J
DB1	MB6S	C1	10nF/1KV
RV1	Patch 10D471	U1、U2、U3	SM2253EKD
R1、R2、R3	6.8R/0805	LED1~LED36	18V/60mA
R4、R5、R6	510K/1206		

1. The LED string voltage is recommended to be controlled between 240V and 260V, and the system works optimally;
2. Adjust operating output current through adjusting R1, R2 and R3;
3. R4, R5 and R6 are system VT detection resistor. The recommended value is 560K, depending on the constant power effect of the scheme;
4. Suggest to keep RV1, FR1 and FR2, to improve system reliability;
5. Suggest to keep C1, D1 and D2, to improve system reliability of resistant high voltage.

◆ SM2253EKD fractional harmonic authentication scheme（30W）

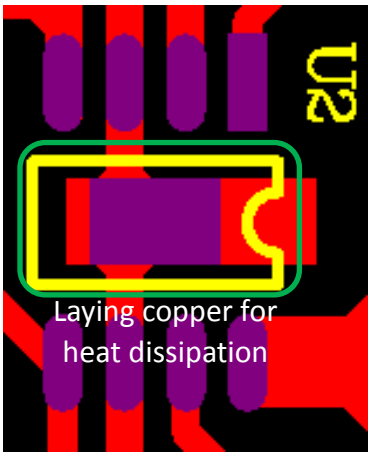


BOM sheet

Bit No.	Parameter	Bit No.	Parameter	Bit No.	Parameter
FR1、FR2	10R/1W winding resistor	R3	7.5R/0805	C2	1uF/16V
RV1	Patch 10D471	R4、R5、R6	120K/1206	U1、U2、U3、U4	SM2253EKD
DB1	MB6S	R8、R9、R10	33K/0805	LED1~LED38	18V/60mA
R1、R2	750Ω/1206	D1、D2	E1J		
R3	6.2Ω/1206	C1	10nF/1KV		

1. The LED string voltage is recommended to be controlled between 240V and 260V, and the system works optimally;
2. R1 and R2 are recommended to take 750Ω, and adjust according to the actual situation to optimize THD;
3. Adjust operating output current through adjusting R4, R5 and R6;
4. Suggest to keep RV1, FR1 and FR2, to improve system reliability;
5. Suggest to keep C1, D1 and D2, to improve system reliability of resistant high voltage.

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.

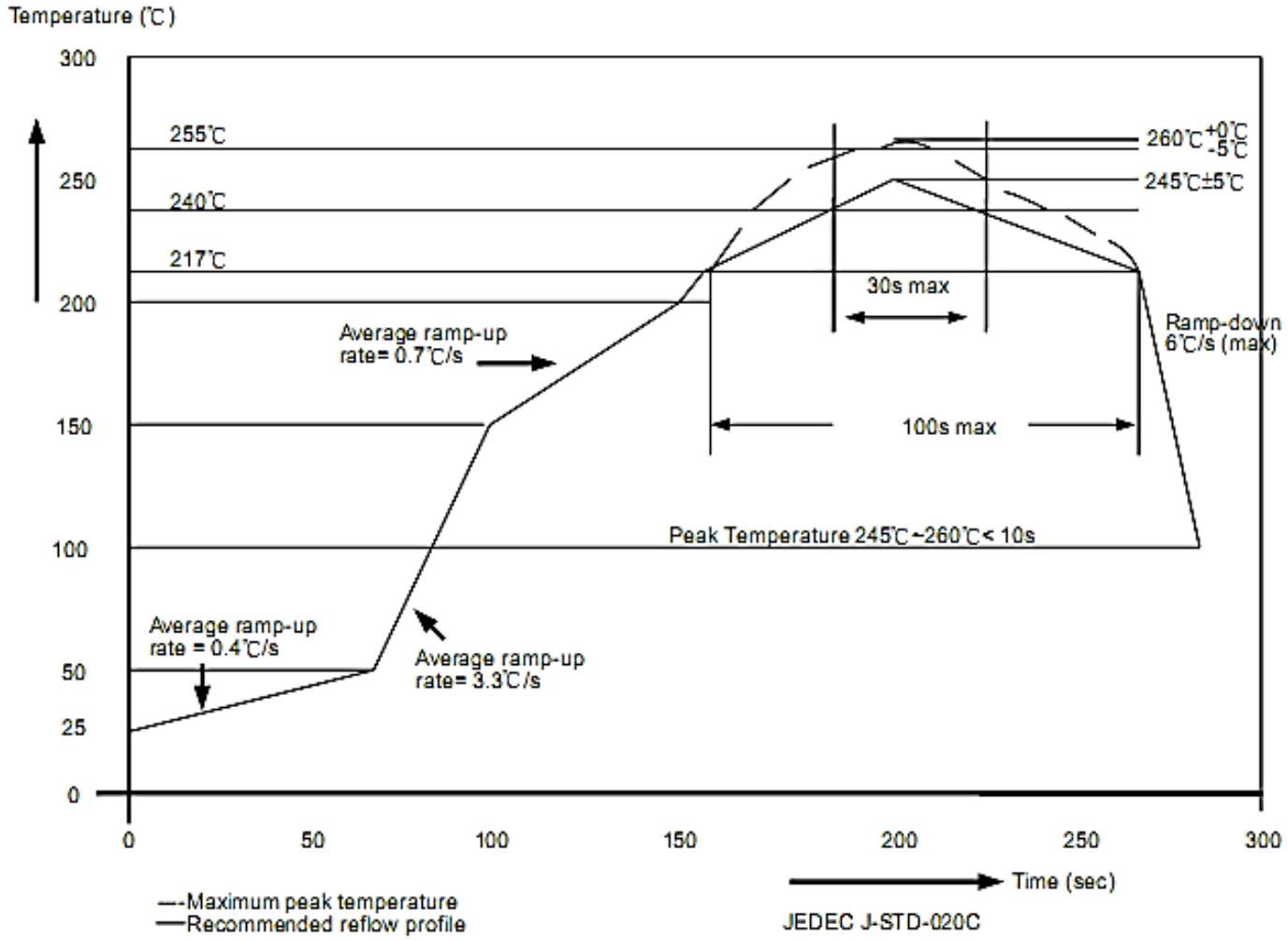
（2） Actual system output power is related to heat dissipation of PCB board and lamp shell, actual application power needs to match heat dissipation condition.

（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 0.6mm away from the OUT port.

Encapsulation Soldering Process

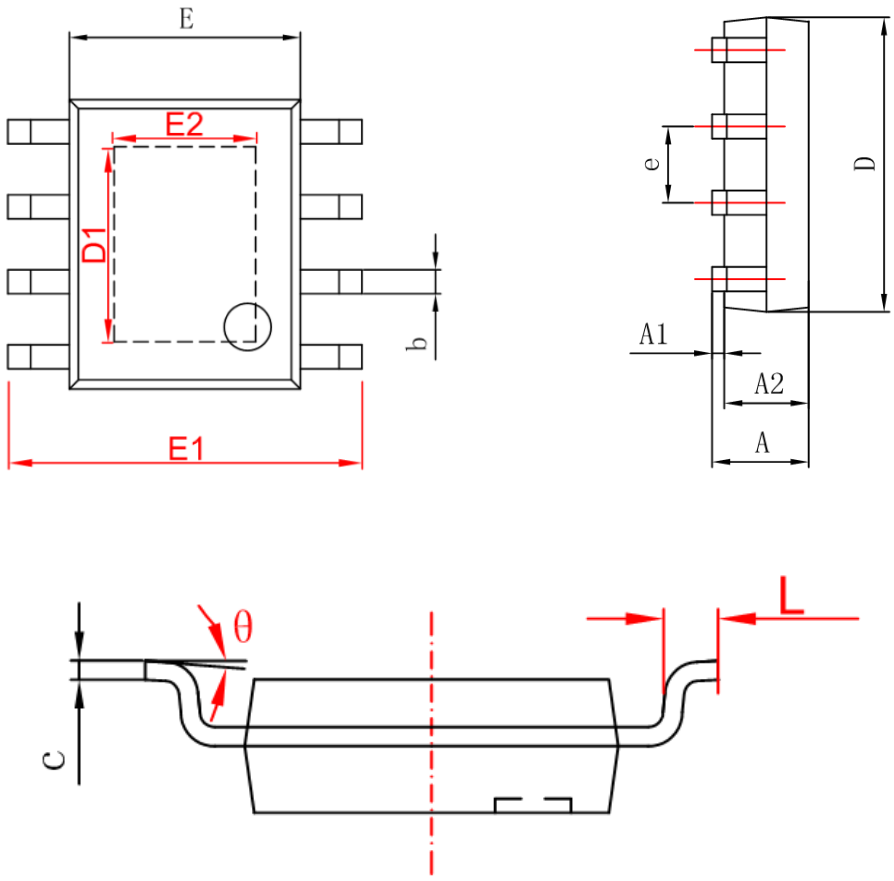
Semiconductors of Sunmoon follow the European RoHs standard, solder temperature in encapsulation soldering process follows J-STD-020 standard.



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°

Declaration

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