SM2082C

Feature

- Patented constant current technology；
  a) The output current is adjustable, ranges from 5mA~60mA;
  b) Precision of CC: <±4%
- OTP
- Sharing PCB board with LED lamps
- Excellent EMC performance
- Simple circuit and lower cost
- Package：ESOP8、TO252-2

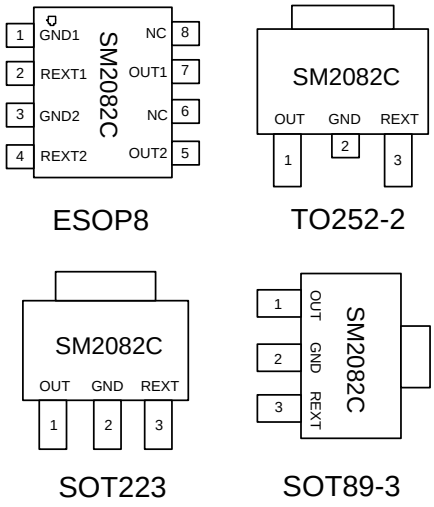
Application

- T5/T8 LED tube lamp
- LED street lighting
- LED bulb lamp, LED ceiling lamp

Description

The SM2082C is a single channel LED linear constant current driver which integrates patented constant current technology. The output current is designed by REXT to be 5mA~60mA, and is invariant to the output voltage variation, which demonstrates the good constant current precision. The cost is low with simple system structure and few peripheral components.

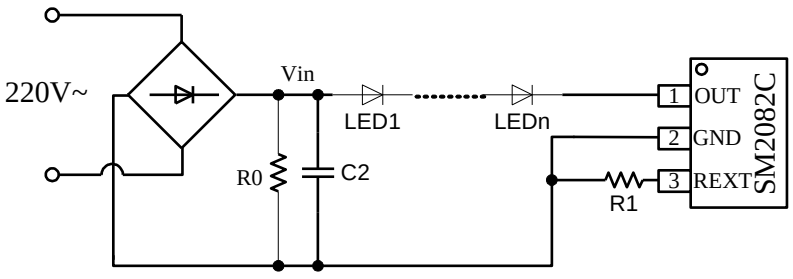
Pin Diagram



ESOP8　　TO252-2

SOT223　　SOT89-3

Typical Application



Note: The above power supply can be AC or DC.

Pin Description

ESOP8		
Name	No.	Pin Description
GND1	1	Ground 1
REXT1	2	Output current setting port of Chip 1
GND2	3	Ground 2
REXT2	4	Output current setting port of Chip 2
OUT2	5	Power supply input and constant current output of Chip 2
OUT1	7	Power supply input and constant current output of Chip 1
NC	6、8	No connection
TO252-2/SOT223/SOT89-3		
Name	No.	Pin Description
OUT	1	Power supply input and constant current output
GND	2	Ground
REXT	3	Output current setting port

Order Information

Model	Package	Packaging		Reel Size
		Tube	Tape	
SM2082C	ESOP8	100000 pcs/box	2500 pcs/tape	13 inches
	TO252-2	15000 pcs/box	2500 pcs/tape	13 inches
	SOT223	/	2500 pcs/tape	13 inches
	SOT89-3	/	1000 pcs/tape	7 inches

Absolute Maximum Parameter

Unless otherwise stated, the ambient temperature is 25°C.

Symbol	Description	Range	Unit
V_{OUT}	Voltage of OUT	-0.5 ~ +500	V
I_{OUT}	Current of OUT	1~ 60	mA
T_{OPT}	Operating temperature	-40 ~ +120	°C
T_{STG}	Storage temperature	-50 ~ +150	°C
V_{ESD}	HBM	2	KV

Thermal Resistor Parameter

Symbol	Description	ESOP8	TO252-2	Unit
R_{THJA}	Thermal resistor(1)	89.2	74.9	℃/W

Note (1): The chip needs to be welded to the PCB with 200 mm^2 cooling copper foil, and the thickness of the copper foil is 35um.

Electric Operating Parameter

Unless otherwise stated, the ambient temperature is 25°C.

Symbol	Description	Condition	Min.	Typ.	Max.	Unit
V_{OUT_MIN}	Input voltage of OUT	IOUT = 30mA	-	-	6.5	V
V_{OUT_BV}	Withstand voltage of OUT	IOUT = 0	500	-	-	V
I_{OUT}	Output current	-----	5	-	60	mA
I_{DD}	Quiescent current	VOUT = 10V， REXT is opened	-	0.16	0.25	mA
V_{REXT}	Voltage of REXT	VOUT = 10V	-	0.6	-	V
D_{IOUT}	Error between chips and chips of IOUT	IOUT = 20mA	-	±4	-	%
T_{SC}	Initial point of the negative temperature compensation of the current	-	-	110	-	℃

Output Current Characteristic of OUT

The output current of the OUT of SM2082C is given by: $I_{OUT} = \frac{V_{REXT}}{rext} = \frac{0.6V}{rext(\Omega e}(A)$。

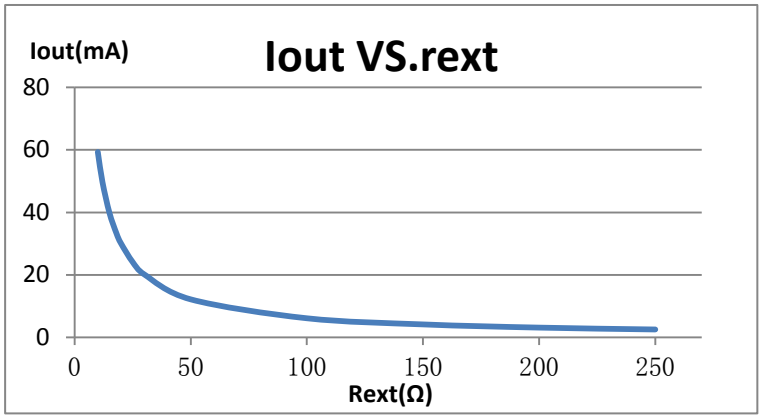


Diagram 1. Relation curve of the output current and rext resistor

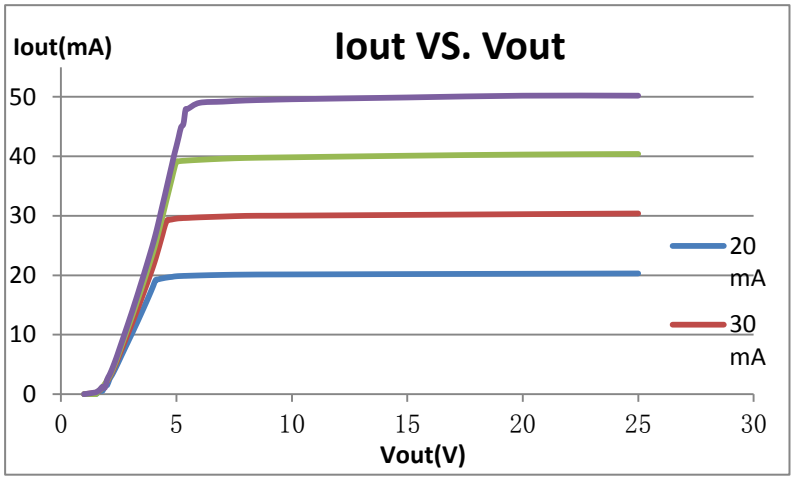


Diagram 2. Constant current curve graph

The minimal voltage of the OUT in normal temperature can be told from the constant current curve, VOUT_MIN：IOUT = 20mA，VOUT_MIN = 4.1V；IOUT = 30mA，VOUT_MIN = 4.6V；IOUT = 40mA，VOUT_MIN = 5.0V；IOUT = 50mA，VOUT_MIN = 5.5V。

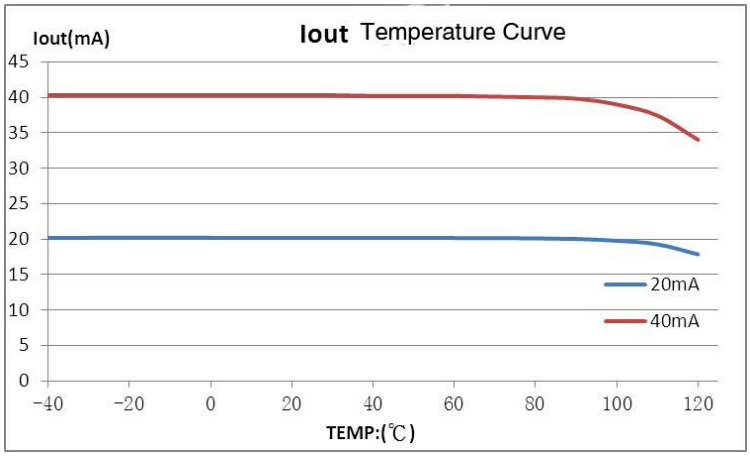


Diagram 3. SM2082C Temperature characteristics of the output current（IOUT = 20mA；IOUT = 40mA）

Temperature Compensation

The exceeded interior temperature of the LED lamp will cause severe light failure and the life span of the LED will be reduced. The SM2082C integrates temperature compensation, when the interior temperature of the chip exceeds 110° C, the output current will be reduced automatically to lower down the interior temperature of the lamp.

Schematic Design of the System

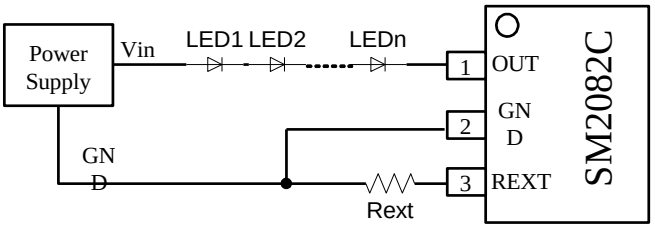


Diagram 4.Schematic Diagram of the application circuit

- Design Theory of Efficiency

The operating efficiency of the application circuit shown in Diagram 4 is given by:

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

Vin is the input power supply and voltage of the system, V_{LED} is the operating voltage drop of a single LED, I_{LED} is the breakover current of LED. It can be told that the larger the number of the series LED n is, the higher the operating efficiency is.

In the designing process of the system, the operating voltage of the OUT needs to be adjusted according to the application environment to optimize the value of η.

- Design of the number of the series LED

Two aspects need to be considered in the design of the number of the series LED:

1) In the circuit of Diagram 4, the voltage of the OUT VOUT = Vin – n*$V_{LED,}$ the voltage of the OUT needs to be guaranteed to be VOUT > VOUT_MIN to guarantee the proper functioning of the chip;

2) The lower the voltage of the OUT is, the higher the operating efficiency is.

To sum up the above two points, the operating voltage range of the OUT is VOUT_MIN ~ VOUT_MAX, the number of the series LED n is given by:

$$\frac{Vin - V_{OUT\_MAX}}{V_{LED}} < n < \frac{Vin - V_{OUT\_MIN}}{V_{LED}}$$

Typical Application

- Single-chip Application

Diagram 5 is the circuit diagram of the AC power supply application, the LED lamps in the LED tube can be connected in series or parallel way or in the way of the mixture of both; C1 is the high-voltage ceramic capacitor, which is used to lower down the voltage of Vin; C2 is the electrolytic capacitor, which is used to lower down the voltage ripple of Vin; The Rext resistor is used in the setting of the operating current of the LED tube.

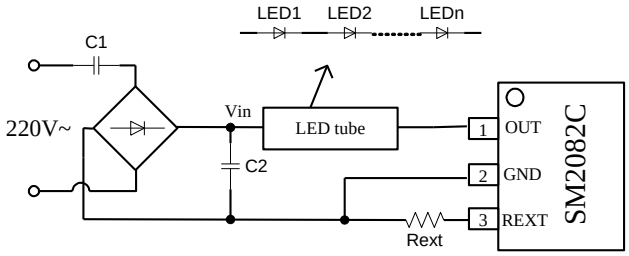


Diagram 5: Typical Application Circuit-----Input of AC Power Supply

The capacity value of the ceramic capacitor C1 depends on the AC voltage and the number of the series LED lamps in the LED tube, normally it takes from 0uF ~ 4.7uF. The C1 capacitor is not needed when the number of the series LED lamp is more enough.

The larger the electrolytic capacitor C2 is, the smaller the ripple of the voltage Vin is, and the smaller the voltage ripple of the OUT is. The value of C2 depends on the total operating current of the LED tube : the larger the current is, the larger the capacity value of C2 is, normally it takes from 4.7uF/400V~22uF/400V, which is given by:

$$\text{The capacity value of the filter capacitor C2:}\quad C_2 = \frac{I_{LED} * t}{\Delta V}$$

ILED is the constant current of the whole scheme, time t: （1/4）*（1/fAC） = 5ms when it is at 50Hz, ΔV is the voltage ripple of the OUT.

- Parallel Application of the Chip

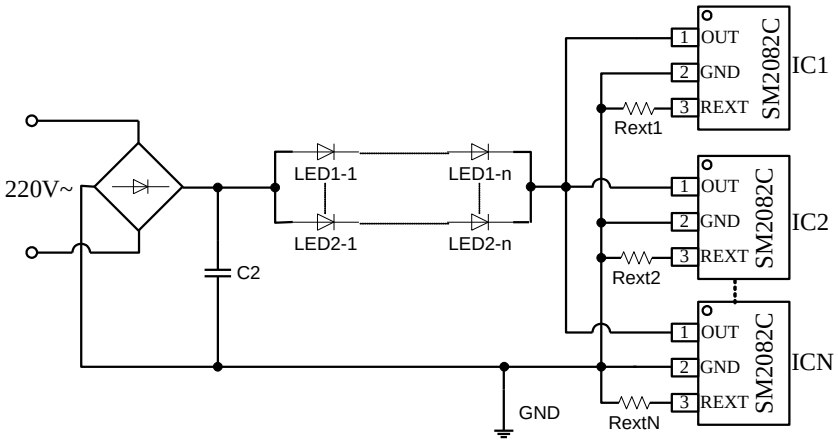


Diagram6. Schematic diagram of the parallel application circuit

Select the number of the parallel chips according to the number of the parallel LED lamps and the operating current of the LED lamp, the resistance of Rext1~RextN can be set to be the same or to be different.

In the parallel application of the chip, when the value of the resistor Rext is different, the constant current threshold voltage of the complete system is the maximal threshold voltage of the parallel chip.

- The Series Connection of the Chip in the LED Tube

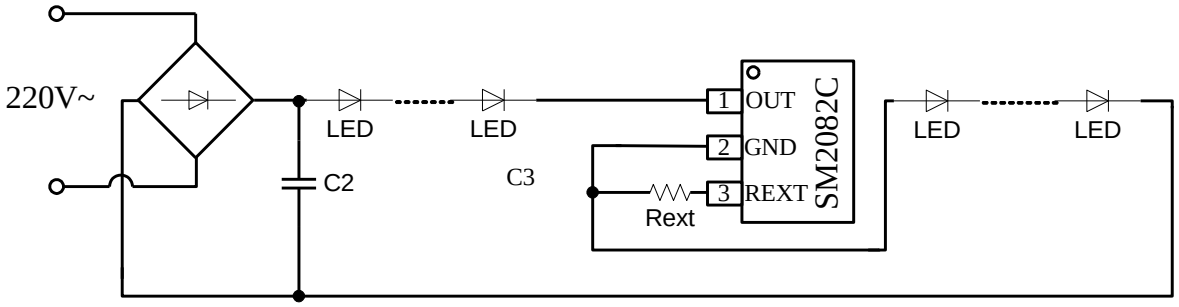
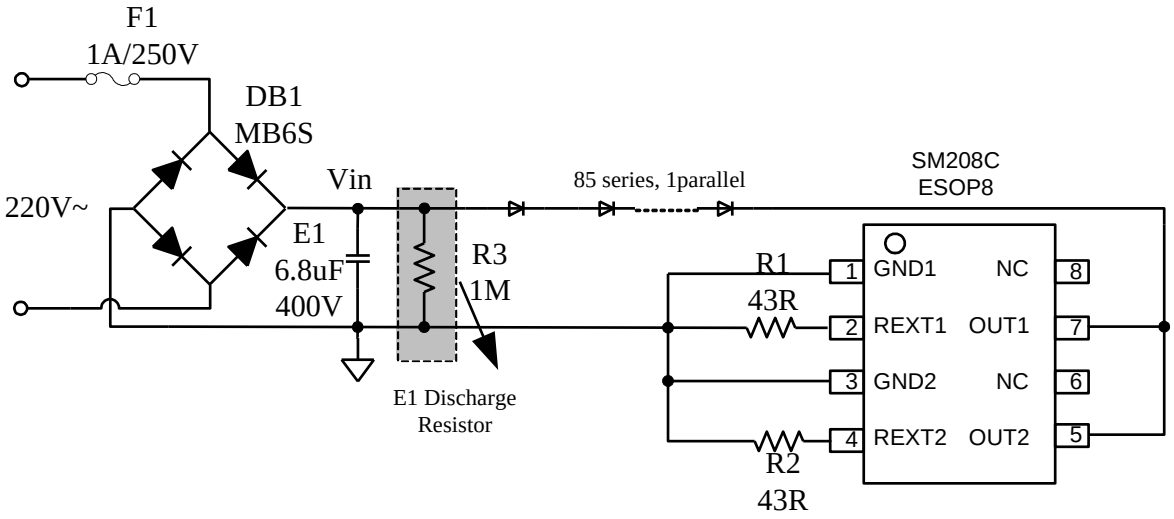


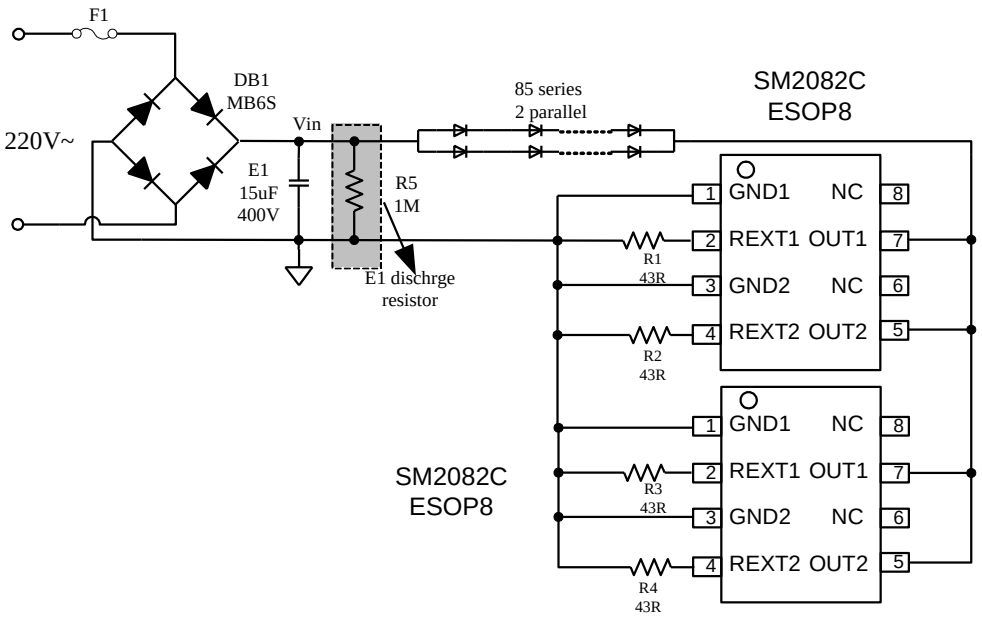
Diagram 7.The series connection of the SM2082C in the LED tube

The chip is connected to the GND, the middle of the LED lamp or ahead of the LED lamp according to different application.

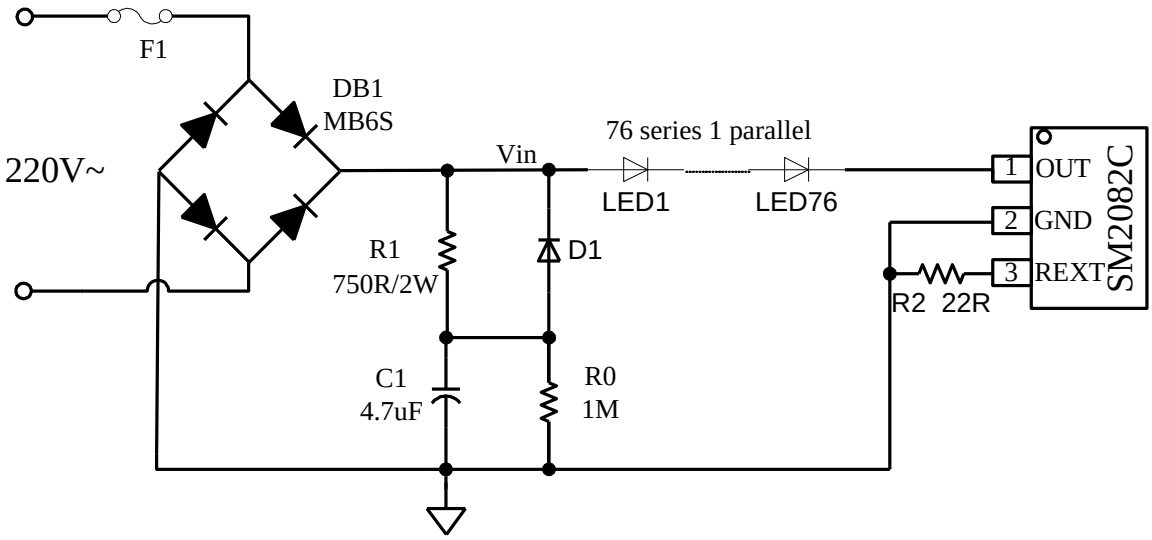
- ESOP8 Package Application：8W



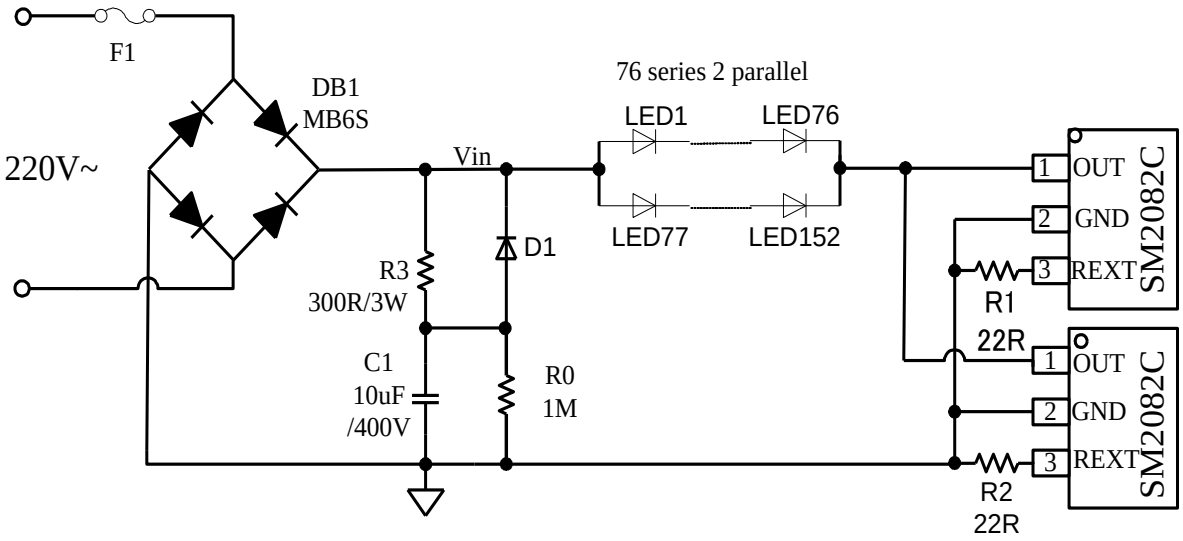
- ESOP8 Package Application：16W



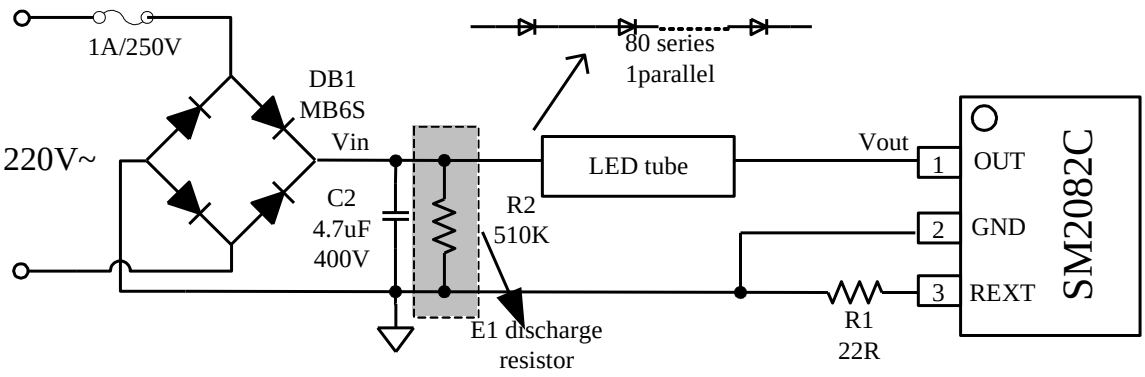
- Application with Valley Fill Circuit：8W



- Application with Valley Fill Circuit： 16W



EMI Test of Typical Application：



EMI Test： Test result of Wire N.

EMI TEST REPORT

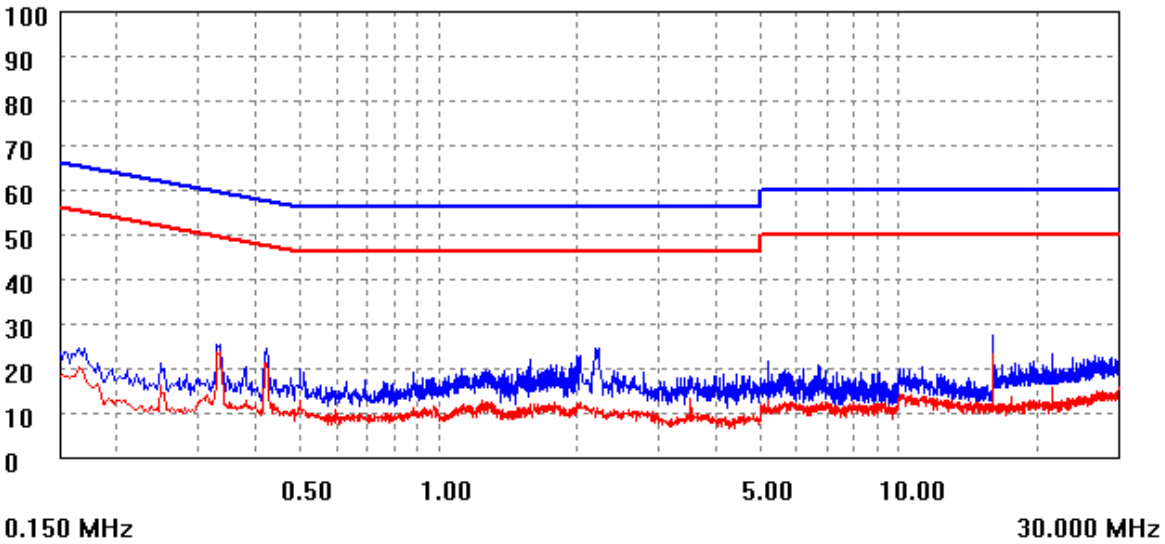
parameter

Organization: MW	Operator: ZXA	EUT:
Place:	Time: 2013/6/18/14:17	Test equipment:KH3935
Detector: PK+AV	Test-time(ms): 20	SN: 1135217
Limit: EN55015	Transductor(PK/AV): PK-1 / AV-1	
Remark:		

freq, step

Start(MHz)	End(MHz)	Step(MHz)
0.150	2.000	0.002
2.000	10.000	0.010
10.000	30.000	0.025

scan result



EMI test： Testing result of line L

EMI TEST REPORT

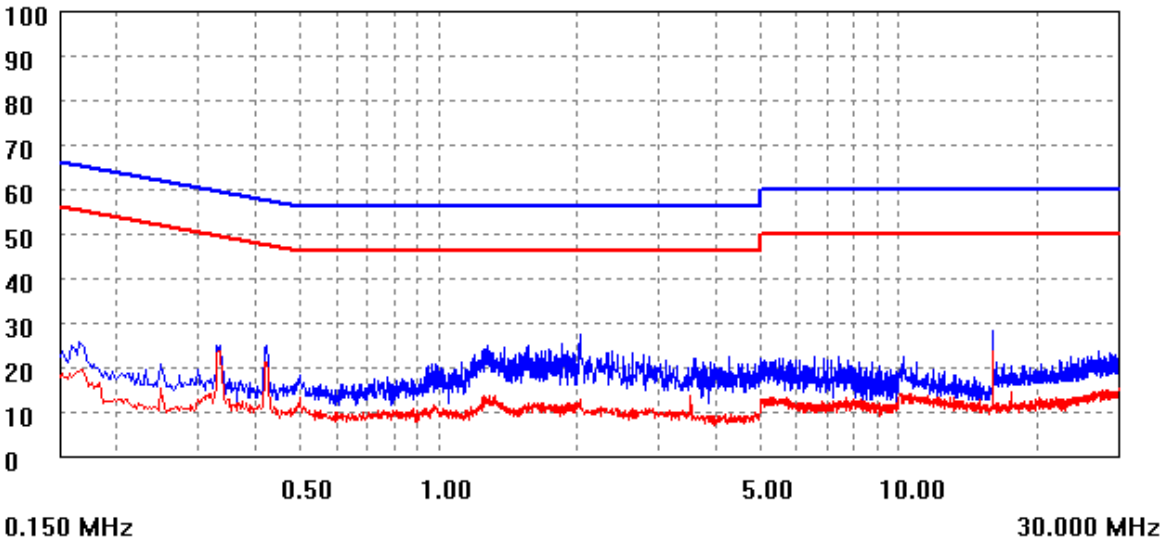
parameter

Organization: MW		Operator:	ZXA	EUT:	
Place:		Time:	2013/6/18/14:20	Test equipment:	KH3935
Detector:	PK+AV	Test-time(ms):	20	SN:	1135217
Limit:	EN55015	Transductor(PK/AV):	PK-1 / AV-1		
Remark:					

freq, step

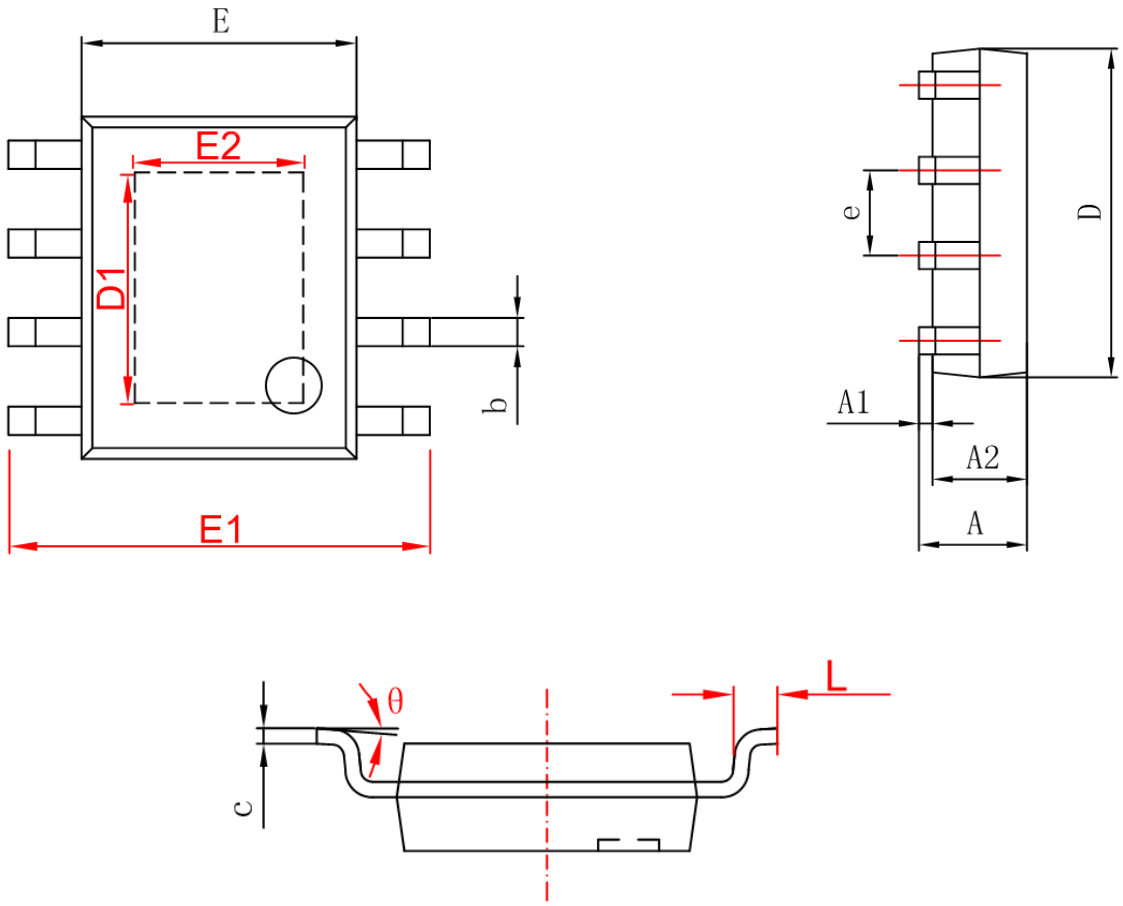
Start(MHz)	End(MHz)	Step(MHz)
0.150	2.000	0.002
2.000	10.000	0.010
10.000	30.000	0.025

scan result



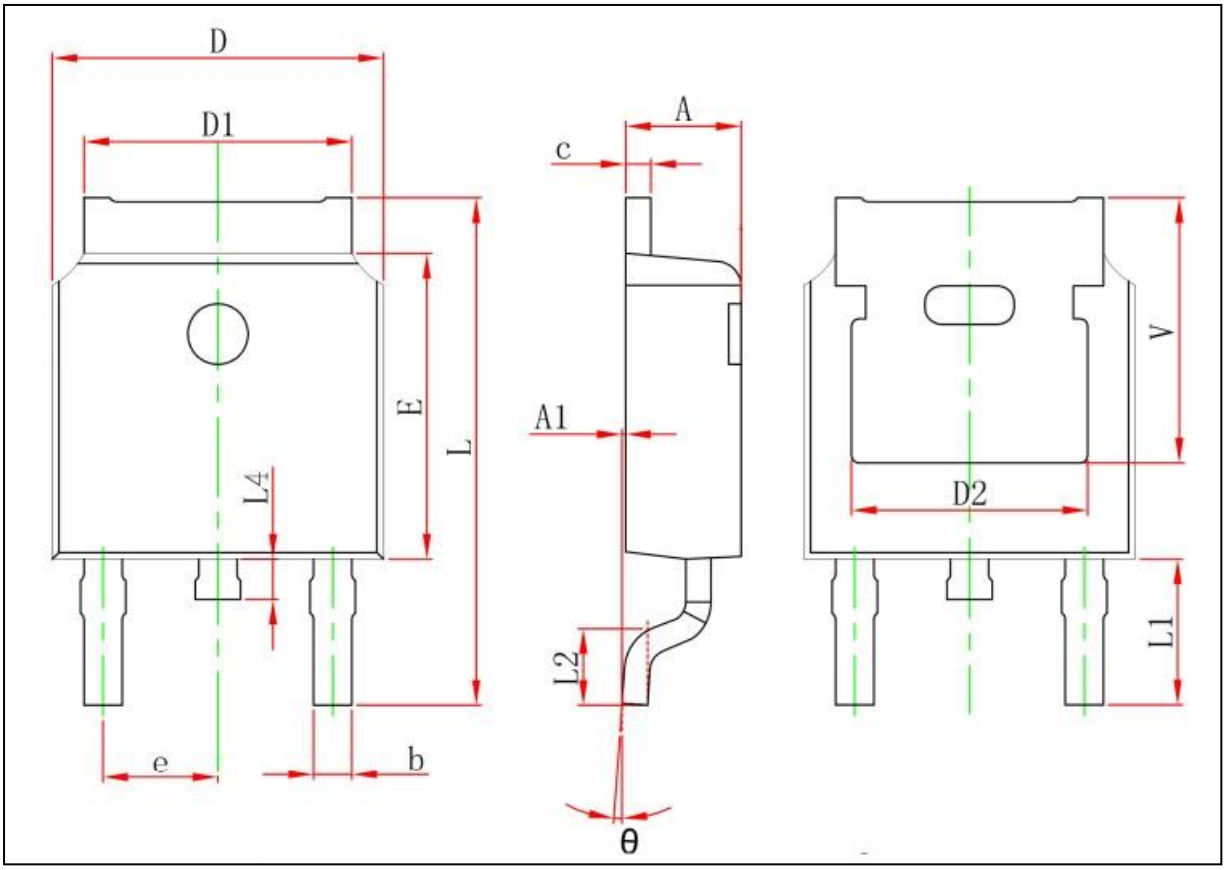
Package

ESOP8



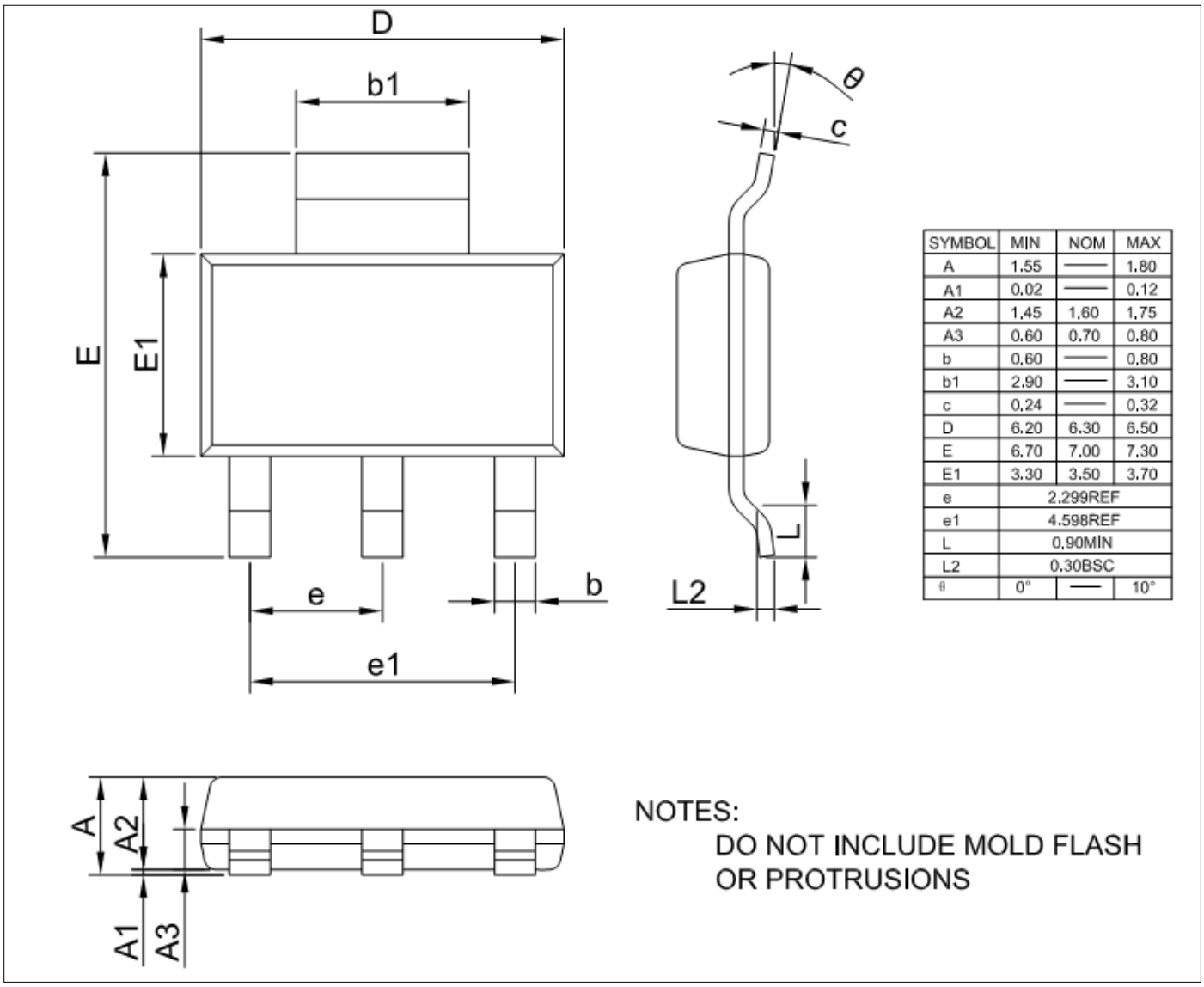
	MILLIMETERS	
	MIN	MAX
A	1.35	1.75
A1	0.05	0.25
A2	1.25	1.65
b	0.31	0.51
c	0.17	0.25
D	4.70	5.10
D1	（1.80--3.40）FYR	
E	3.80	4.00
E1	5.80	6.20
E2	（1.80--2.60）FYR	
e	1.270(BSC)	
L	0.40	0.80
Θ	0°	8°

TO252-2：(Different grinders have slight different identification holes and reverse pins, which will not affect the performance.)



Symbol	Dimensions In Millimeters	
	Min.	Max.
A	2.200	2.420
A1	0.000	0.127
b	0.550	0.850
c	0.450	0.600
D	6.400	6.700
D1	5.100	5.500
D2	4.830 REF.	
E	5.950	6.250
e	2.280 REF.	
L	9.400	10.400
L1	2.750 REF.	
L2	1.400	1.700
L4	0.600	1.000
θ	0°	8°
V	5.350 REF.	

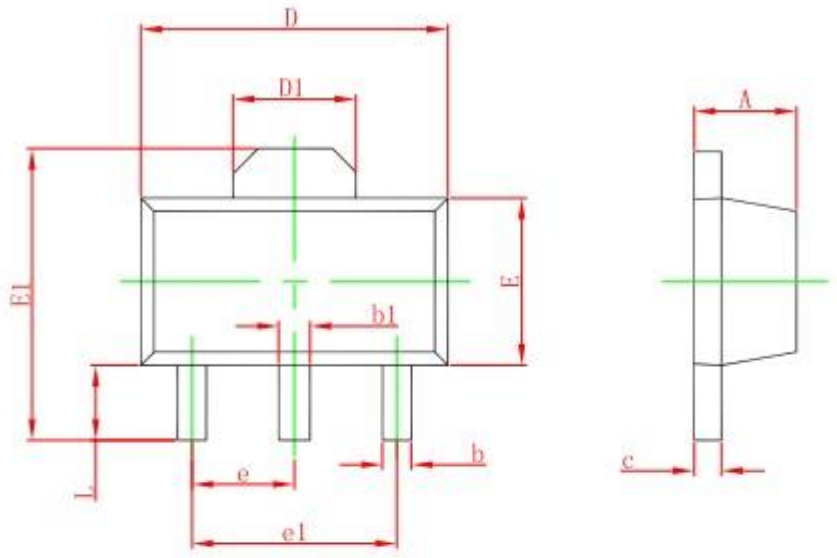
SOT223



SYMBOL	MIN	NOM	MAX
A	1.55	——	1.80
A1	0.02	——	0.12
A2	1.45	1.60	1.75
A3	0.60	0.70	0.80
b	0.60	——	0.80
b1	2.90	——	3.10
c	0.24	——	0.32
D	6.20	6.30	6.50
E	6.70	7.00	7.30
E1	3.30	3.50	3.70
e	2.299REF		
e1	4.598REF		
L	0.90MIN		
L2	0.30BSC		
θ	0°	——	10°

NOTES:
DO NOT INCLUDE MOLD FLASH
OR PROTRUSIONS

SOT89-3



Symbol	Dimensions In Millimeters	
	Min.	Max.
A	1.400	1.600
b	0.320	0.550
b1	0.400	0.580
c	0.350	0.450
D	4.400	4.600
D1	1.550 REF.	
E	2.300	2.600
E1	3.940	4.300
e	1.500 TYP.	
e1	3.000 TYP.	
L	0.900	1.200