SM2082D

Feature

- Patented constant current technology
  a) Adjustable OUT output current: 5mA~60mA
  b) Output current error between chip and chip: < ±4%
- OTP
- Share PCB with LED
- Excellent EMC performance
- Simple circuit and low cost
- Package: TO252-2
- 18W LED tube manufacture with one chip

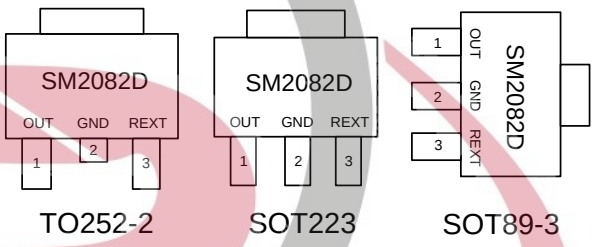
Application

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

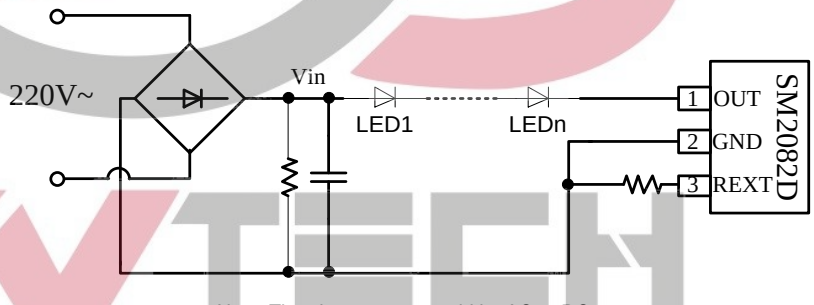
Description

The SM2082D is a single channel LED constant current driver which adopts the patented constant current control technology. The output current is adjustable through the external Rext (5mA~60mA), and the chip is with excellent constant current performance that the output current is not varied with the variation of the OUT voltage. The cost is low with simple structure and fewer peripheral components.

Pin Diagram



Typical Application



Note: The above power could be AC or DC.

Pin Description

Pin Name	Pin No.	Pin Description
OUT	1	Constant current output port
GND	2	Ground
REXT	3	Output current setting port

Order Information

Type	Package	Packing		Reel Size
		Tube	Tape	
SM2082D	TO252-2	15000 pcs/box	2500 pcs/box	13 inches

Absolute Maximum Parameter

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

Symbol	Description	Range	Unit
V_{OUT}	OUT voltage	-0.5 ~ +450	V
I_{OUT}	OUT current	1~ 60	mA
T_{OPT}	Operating temperature	-40 ~ 125	°C
T_{STG}	Storage temperature	-50 ~ 150	°C
V_{ESD}	ESD withstand voltage	＞2	KV

Thermal Resistor

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

Note (1): The chip needs to be welded to the PCB with 200mm² 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}	OUT input voltage	IOUT = 30mA	-	-	6.5	V
V_{OUT_BV}	OUT withstand voltage	IOUT = 0	450	-	-	V
I_{OUT}	Output current	-----	5	-	60	mA
I_{DD}	Quiescent current	VOUT = 10V，REXT: NC	-	0.16	0.25	mA
V_{REXT}	REXT voltage	VOUT = 10V	-	0.6	-	V
D_{IOUT}	IOUT error between chip and chip	IOUT = 20mA	-	±4	-	%
T_{SC}	Initial point of the negative temperature compensation	-	-	110	-	℃

OUT Output Current Characteristic

The OUT output current of SM2082D is given by: $I_{OUT} = \frac{V_{REXT}}{rext} = \frac{0.6V}{rext(\Omega)}(A)$。

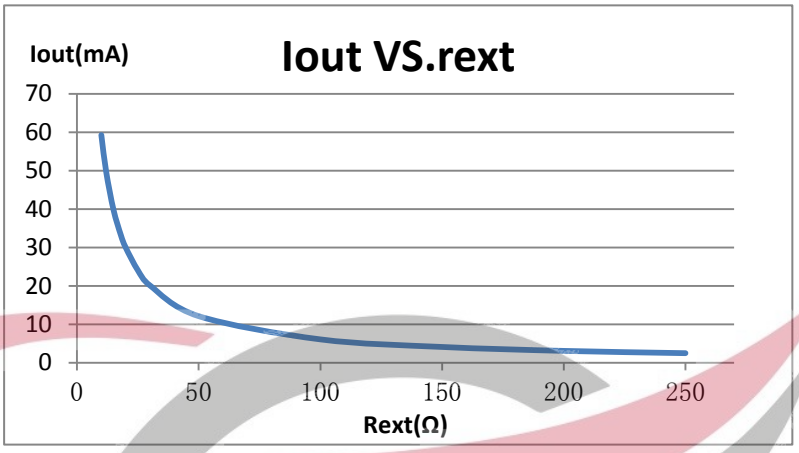


Diagram 1. Relation Curve between SM2082D Output Current and rext

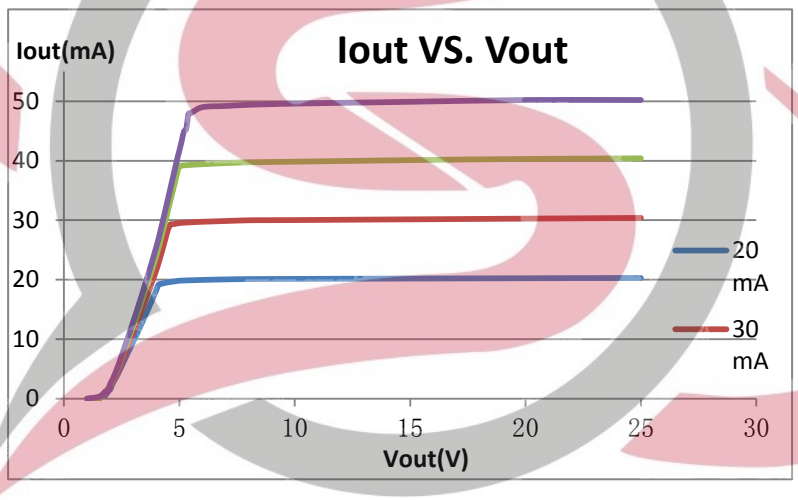


Diagram 2. SM2082D Constant Current Curve

From the SM2082D constant current curve on Diagram 2, the OUT minimal voltage under normal temperature: IOUT = 20mA, VOUT_MIN = 4.1V; IOUT = 30mA, VOUT_MIN = 4.6V; IOUT = 40mA, VOUT_MIN = 5.0V; IOUT = 50mA, VOUT_MIN = 5.5V.

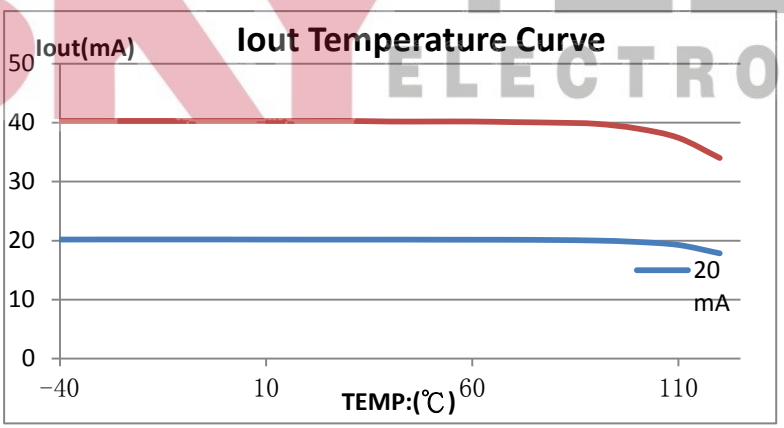


Diagram 3. SM2082D Output Current Temperature Characteristic （IOUT = 20mA；IOUT = 40mA）

Temperature Compensation

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 SM2082D integrates temperature compensation, when the interior Tj of the chip exceeds 110° C, the output current will be decreased automatically to lower down the interior temperature of the LED.

System Scheme Design

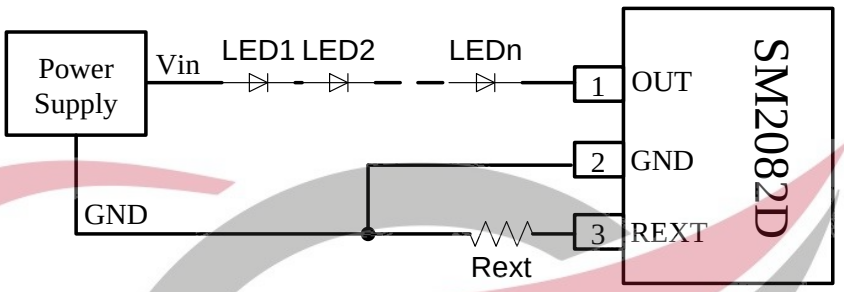


Diagram 4. SM2082D Application Circuit Schematic Diagram

- Theory of Efficiency Design

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 voltage, V_{LED} is the forward voltage of a single LED, I_{LED} is the operating current of LED. Therefore, the bigger the number (n) of the cascaded LEDs is, the higher the operating efficiency is.

During the design of the system, the OUT operating voltage of the SM2082D needs to be adjusted in accordance with the application environment to optimize η.

- Design of Number of Cascaded LEDs

Two aspects need to be considered in the design of the number of cascaded LEDs:

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

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

In conclusion, the OUT operating voltage range is: V_{OUT_MIN} ~ V_{OUT_MAX}, and the number of cascaded LEDs 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 SM2082D application circuit diagram, the LED lamps in the LED tube can be connected in cascade or in parallel or in combination of both; C1 is high-voltage ceramic capacitor, which is used to low down voltage of Vin; C2 is electrolytic capacitor, which is used to lower down voltage ripple of Vin; Rext is used to set the operating current of LED tube.

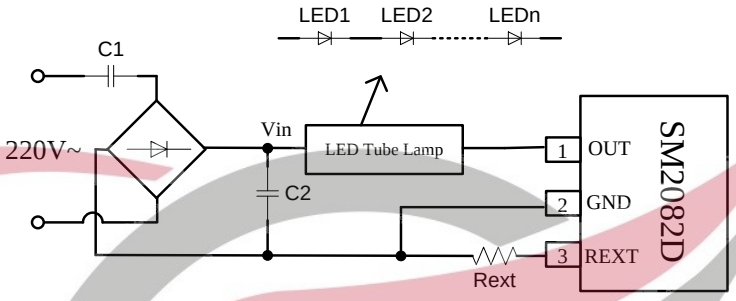


Diagram 5. Typical Application Circuit—AC Power Input

The value of C1 is determined by the AC voltage and the number of the cascaded LEDs in the LED tube lamp, and normally it's 0uF ~ 4.7uF. When the number of the cascaded LEDs is big enough, C1 is not needed.

The higher C2 is, the lower the Vin ripple and the OUT voltage ripple are. The value of C2 is determined by the summed operating current of the LED tube lamp: the higher the current is, the bigger the value of C2 is, normally it's 4.7uF/400V~22uF/400V, and the specific value is given by:

$$C_2 = \frac{I_{LED} * t}{\Delta V}$$

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

- Parallel-chip Application

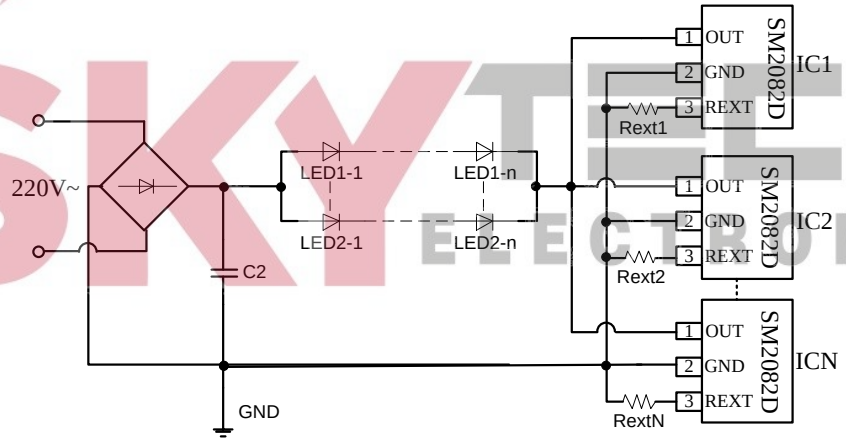


Diagram 6. Circuit Schematic Diagram of Parallel Application

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

In the parallel-chip application, the system constant current threshold voltage is the maximal threshold voltage of the parallel

SM2082D when the values of the Rext are different.

- Cascaded-chip in LED Tube Lamp

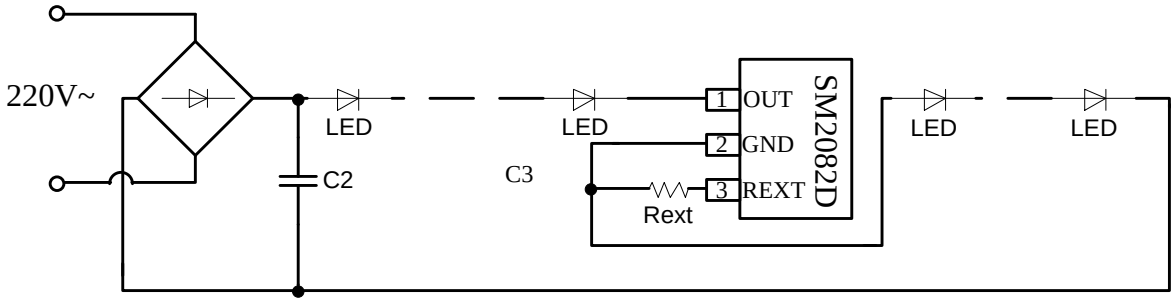
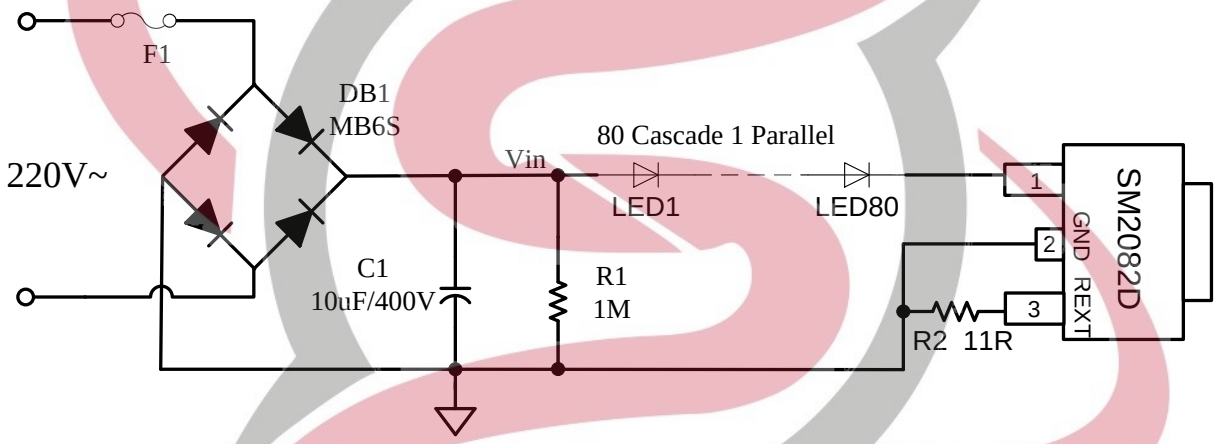


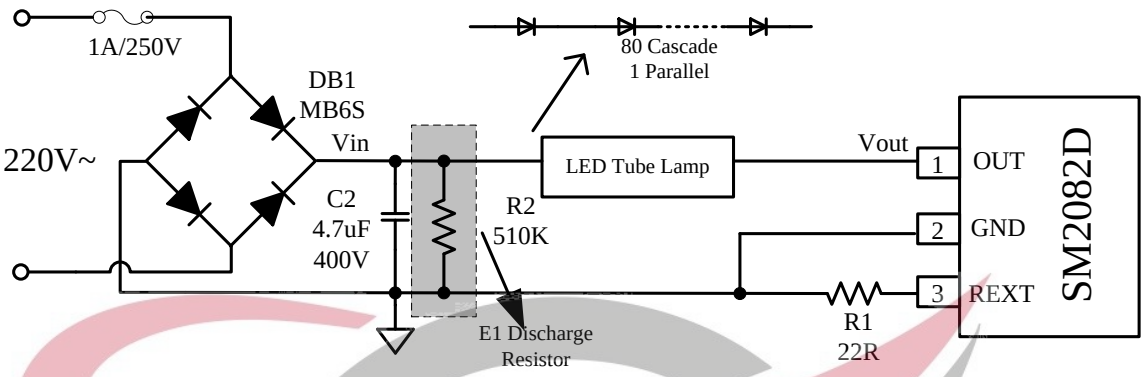
Diagram 7. SM2082D Cascaded in LED Tube Lamp

The SM2082D can be connected at GND, middle of the LED lamp or front of the LED lamp according to different application.

- TO252 Application: 18W



Typical Application EMI Test:



EMI Test: N Line Test Report

EMI TEST REPORT

parameter

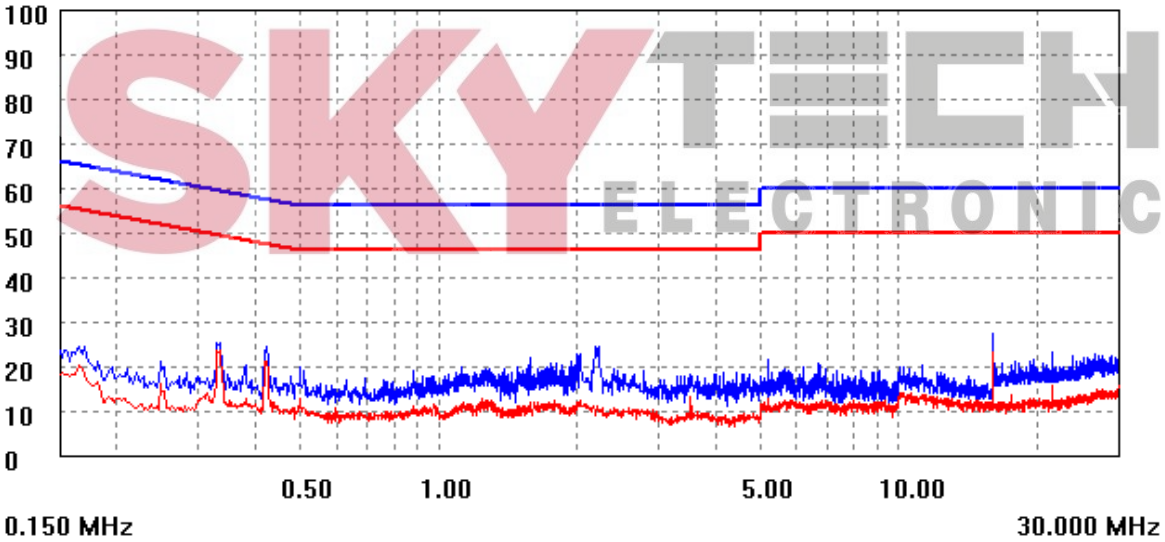
Organization: MW	Operator: ZXA	EUT:
Place:	Time: 2013/6/18/14:17	Test equipment:KH3935
Detector: PK+AV	Test-time(ms): 20	SN: 1135217
Limit: EN55015	Transductor(PK/AV): PK-1 / AV-1	
Remark:		

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

dBuV



EMI Test: L Line Test Report

EMI TEST REPORT

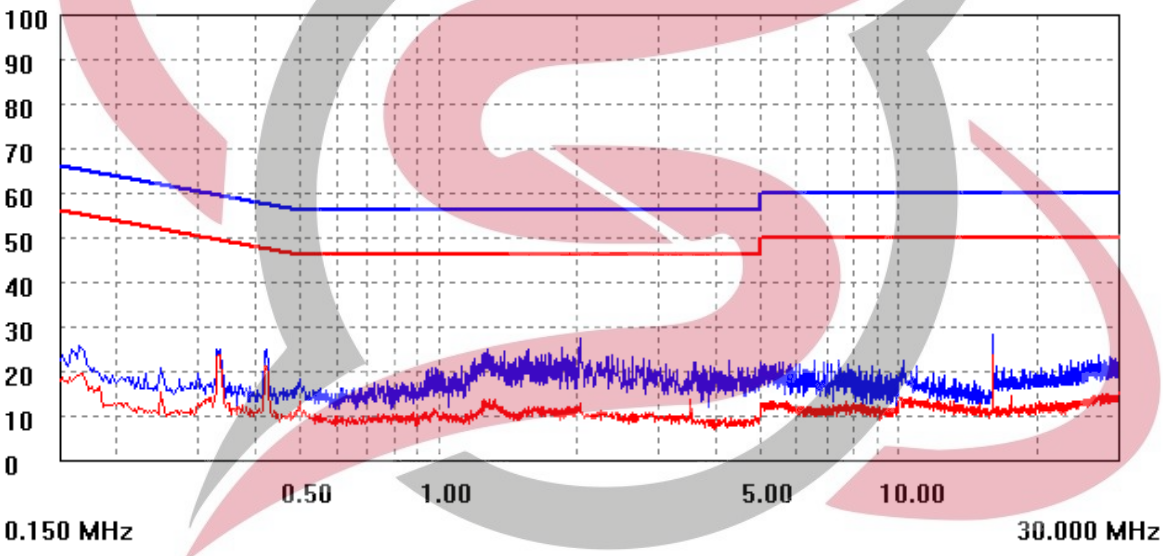
parameter

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

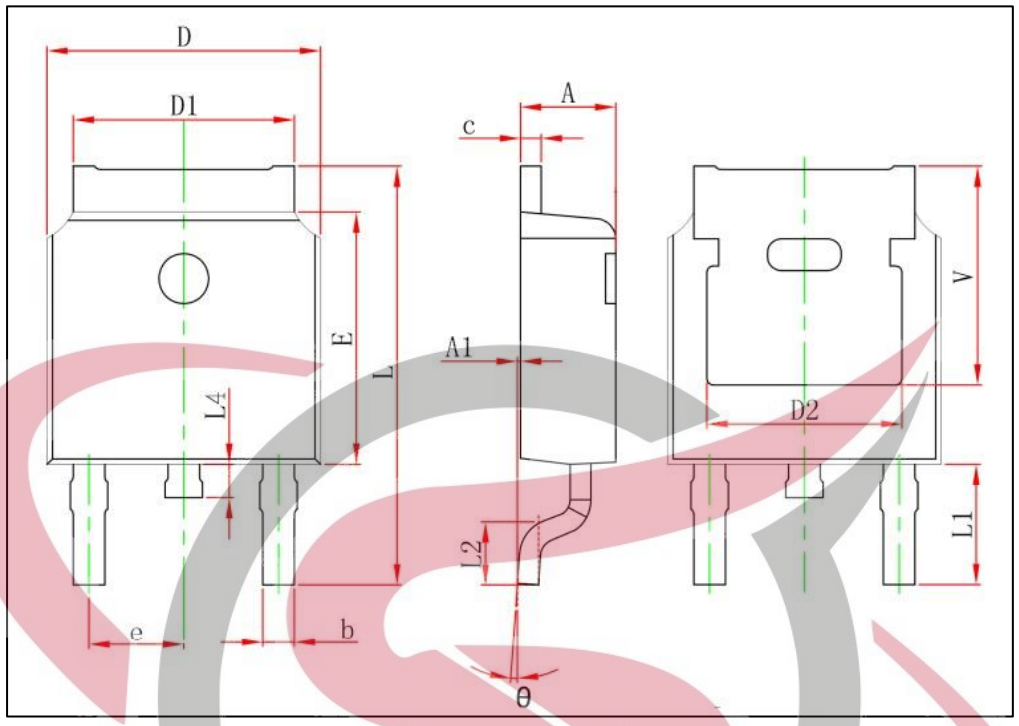
Start(MHz)	End(MHz)	Step(MHz)
0.150	2.000	0.002
2.000	10.000	0.010
10.000	30.000	0.025

scan result



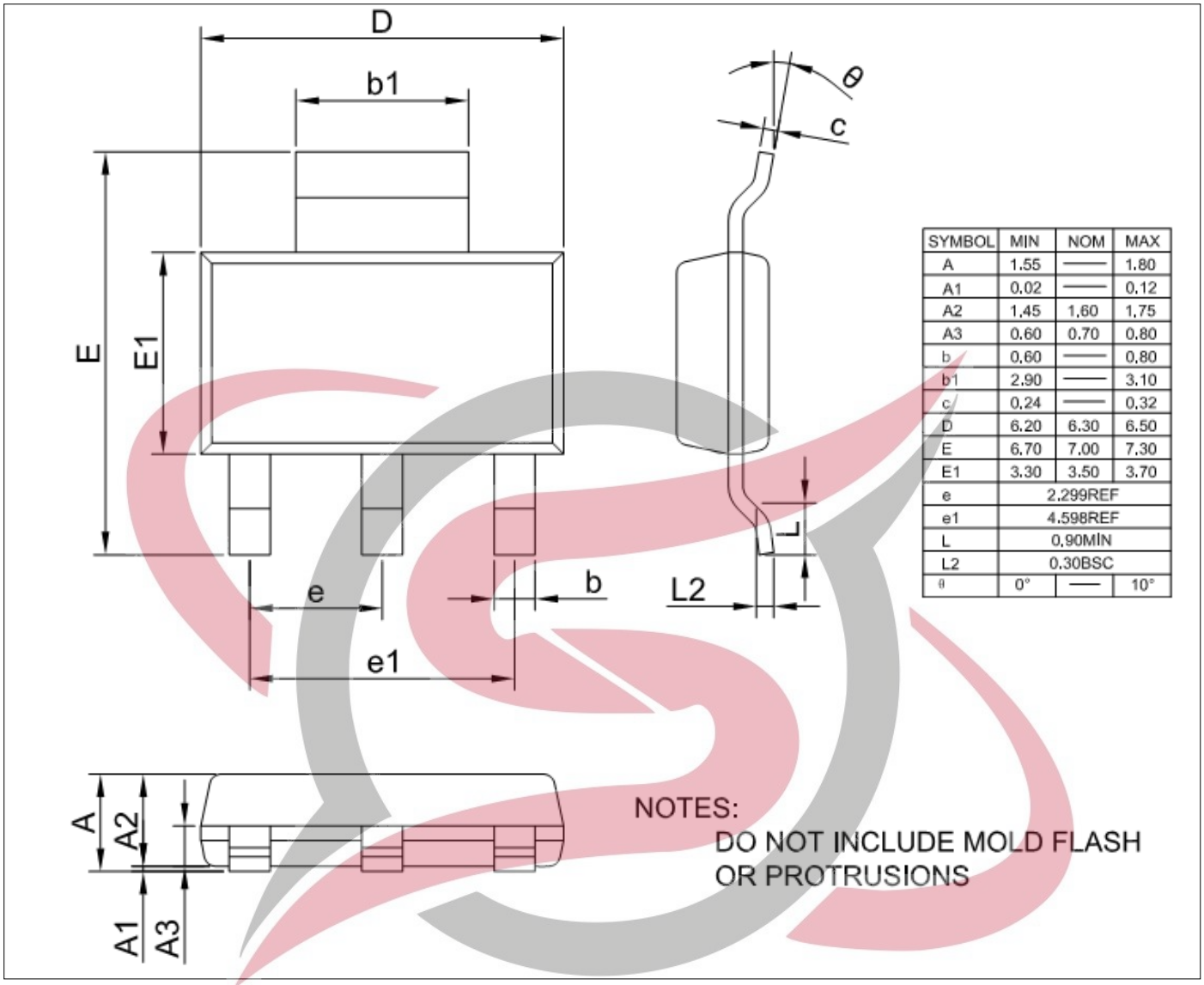
Package

TO252-2



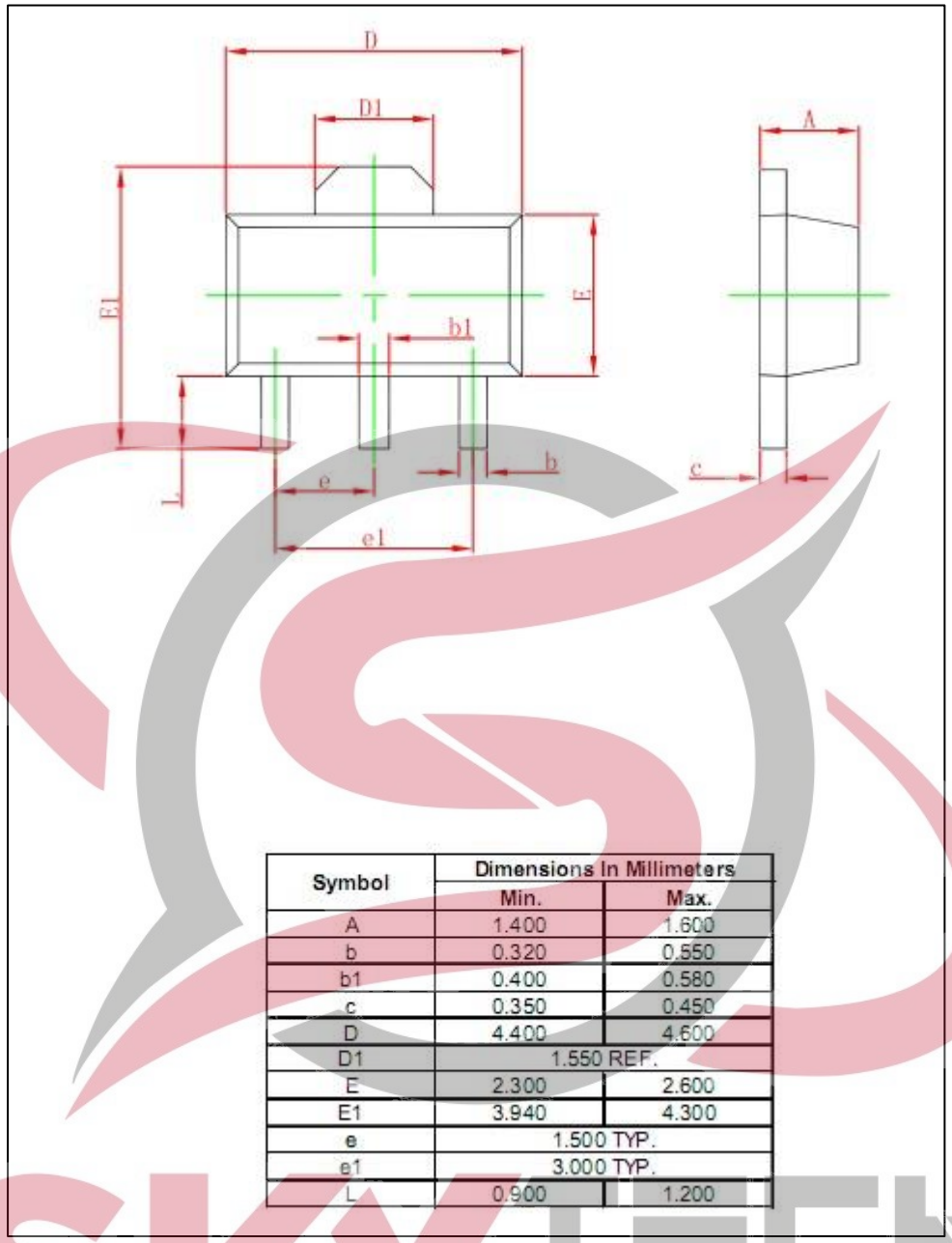
Symbol	Dimensions In Millimeters	
	Min.	Max.
A	2.200	2.420
A1	0.000	0.127
b	0.550	0.850
c	0.450	0.600
D	6.400	6.700
D1	5.100	5.500
D2	4.830 REF.	
E	5.950	6.250
e	2.280 REF.	
L	9.400	10.400
L1	2.750 REF.	
L2	1.400	1.700
L4	0.600	1.000
θ	0°	8°
V	5.350 REF.	

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°

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