LED CONSTANT CURRENT DRIVER

Feature

- Patented constant current technology
  a) Adjustable OUT output current: 5mA~60mA
  b) Output current error between chip and chip: < ±4%
- Input AC voltage: 120V/220V
- Support SCR dimming Application
- Overheating protection
- Share PCB with LED
- Simple circuit and low cost
- Package: TO-252, SOT-89

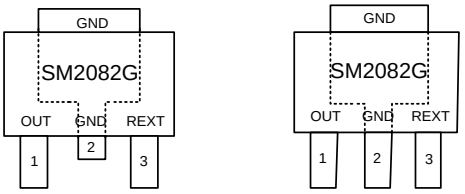
Application

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

Description

The FC2082G 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.

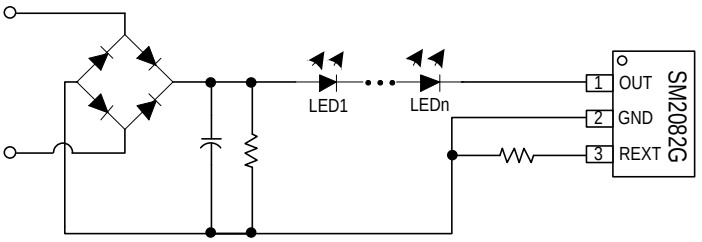
Pin Diagram



TO-252
(FC2082GD)

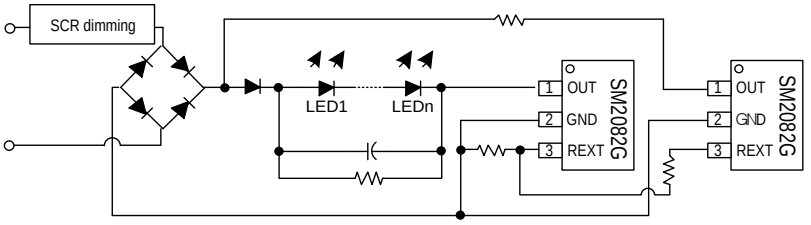
SOT-89
(FC2082GF)

Typical Application1 NO Dimming application circuit



Note: The above power could be AC or DC.

Typical Application2 Dimming application circuit



Pin Description

TO-252 / SOT-89		
Pin No.	Pin Name	Pin Description
1	OUT	The power input and Constant current output port
2	GND	Ground
3	REXT	Output current setting port

Order Information

Part Number	Package	Packing		Reel Size
		Tube	Tape	
FC2082GD	TO-252	/	2500 pcs/ tape	13 inches
FC2082GF	SOT-89	/	4000 pcs/ tape	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
$R_{\theta JA}$	PN junction to ambient thermal resistance	TO-252	55	°C/W
		SOT-89	125	
T_J	Operating junction temperature range	-40 ~ 150		°C
T_{STG}	Storage temperature	-55 ~ 150		°C
V_{ESD}	HBM human discharge mode	>2		KV

Note: The highest temperature of SMT product can't exceed 260°C, the temperature curve should be seted up by factory itself, which based on J-STD-020 Standard, the factory practice and solder paste supplier's suggestion.

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	-	-	130	-	°C

OUT Output Current Characteristic

The OUT output current of FC2082G is given by: $I_{OUT} = \frac{V_{REXT}}{rext} = \frac{0.6V}{rext(\Omega)}(A)$

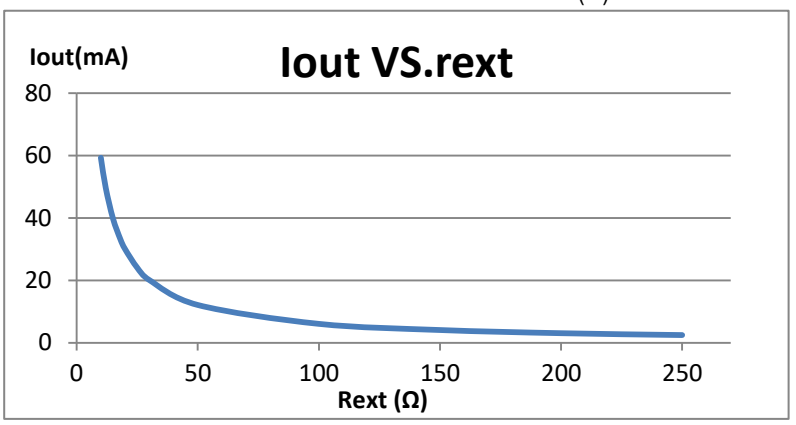


Diagram 1. Relation Curve between FC2082G Output Current and rext

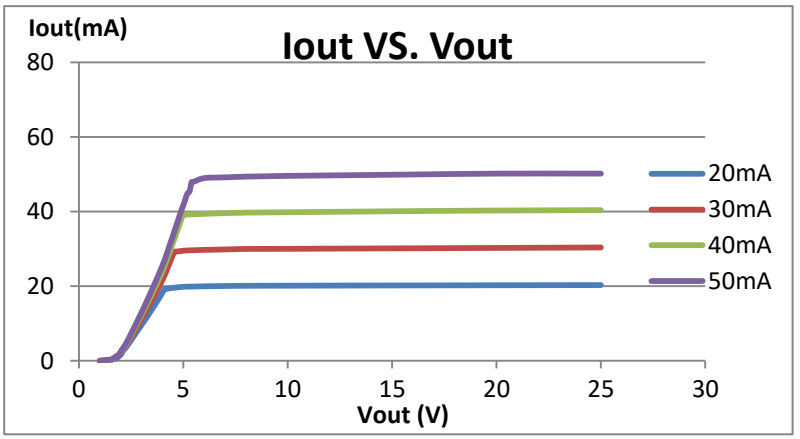


Diagram 2. FC2082G Constant Current Curve

From the FC2082G 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.

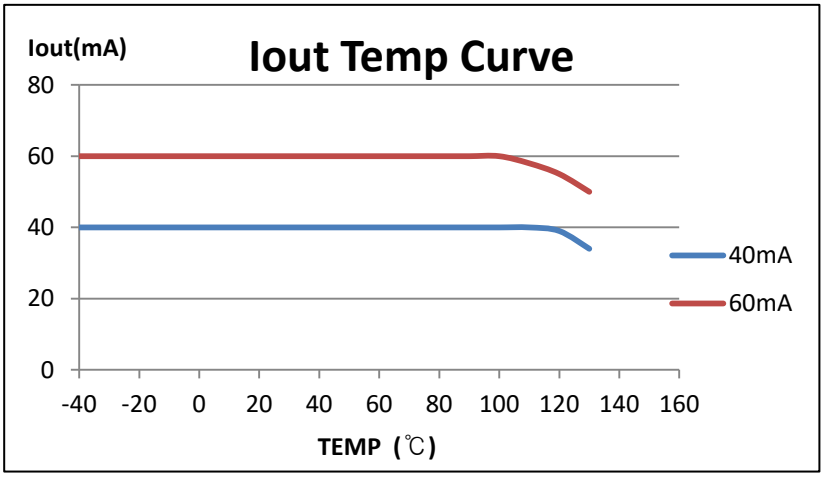


Diagram 3. FC2082G Output Current Temperature Characteristic

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 FC2082G integrates temperature compensation, when the interior Tj of the chip exceeds 130℃, the output current will be decreased automatically to lower down the interior temperature of the LED.

System Scheme Design

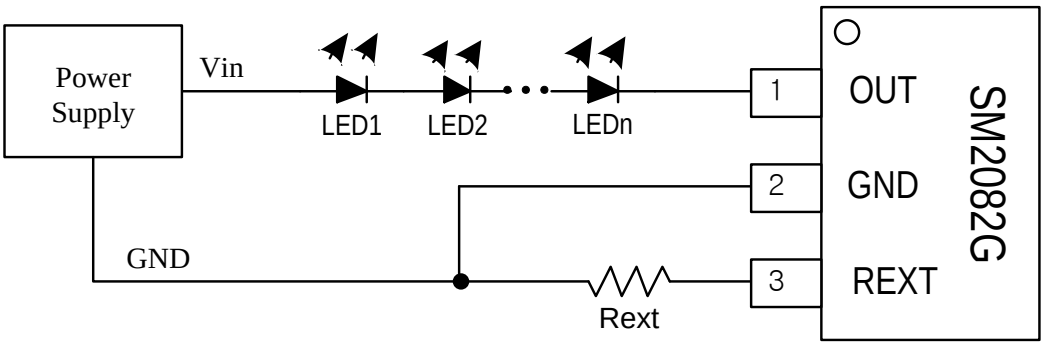


Diagram 4. FC2082G Application Circuit Schematic Diagram

- 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 FC2082G 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:

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

Application Description

- Single-chip Application

Diagram 5 is the FC2082G 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.

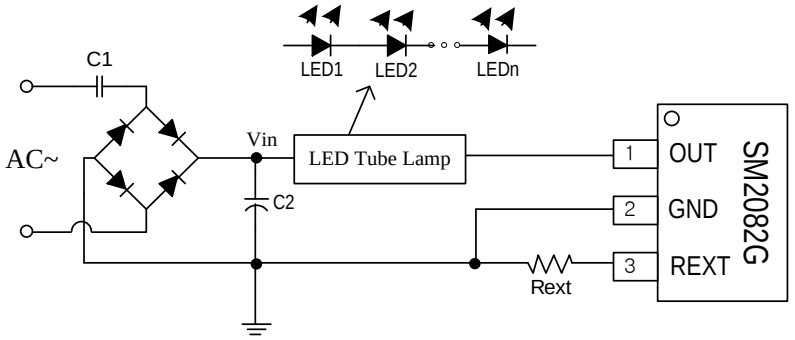


Diagram 5. Typical Application Circuit— AC Power Input

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

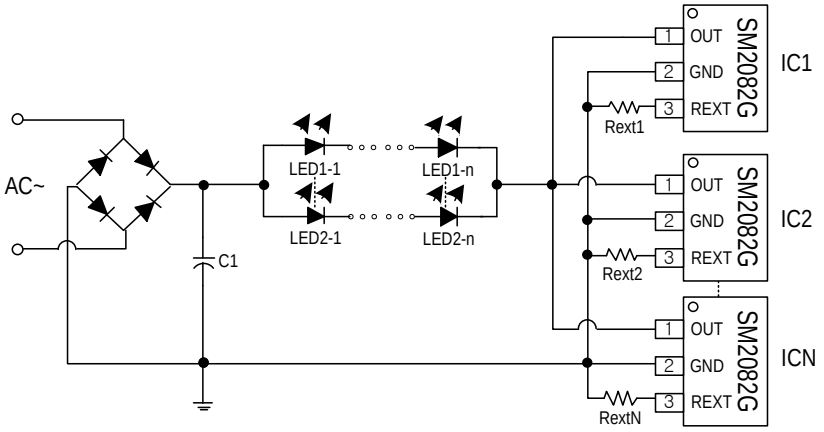


Diagram 6. Circuit Schematic Diagram of Parallel Application

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

FC2082G when the values of the Rext are different.

- Cascaded-chip in LED Tube Lamp

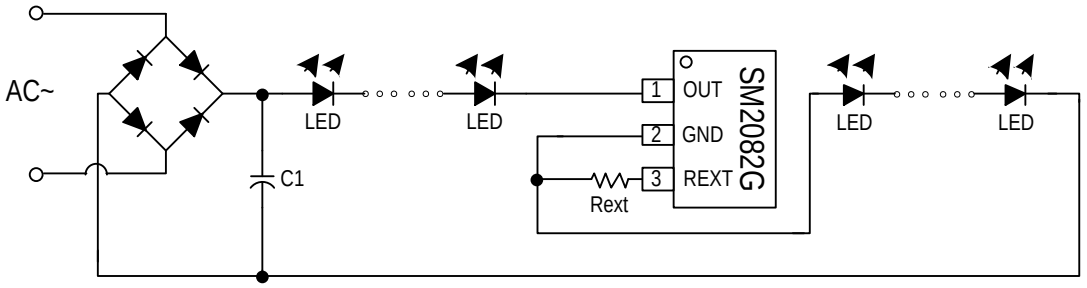
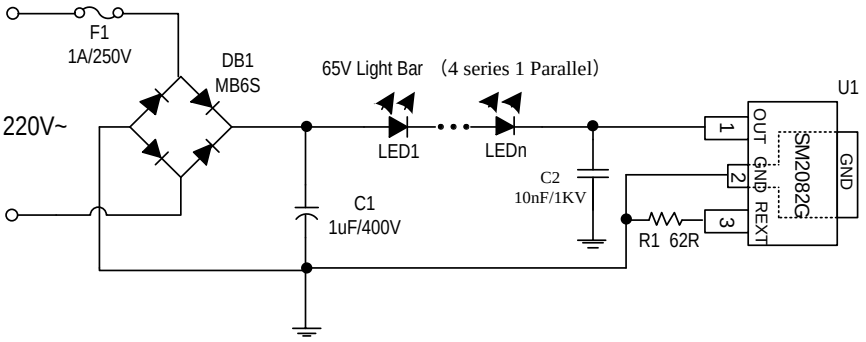


Diagram 7. FC2082G Cascaded in LED Tube Lamp

The FC2082G can be connected at GND, middle of the LED lamp or front of the LED lamp according to different application.

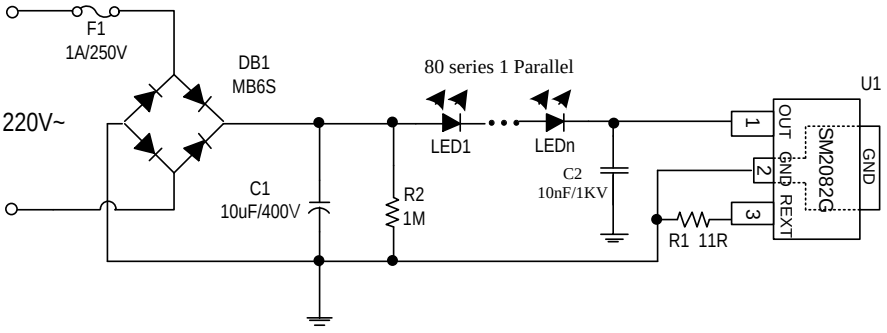
Typical Application

- SOT-89 No flicker Application：3W



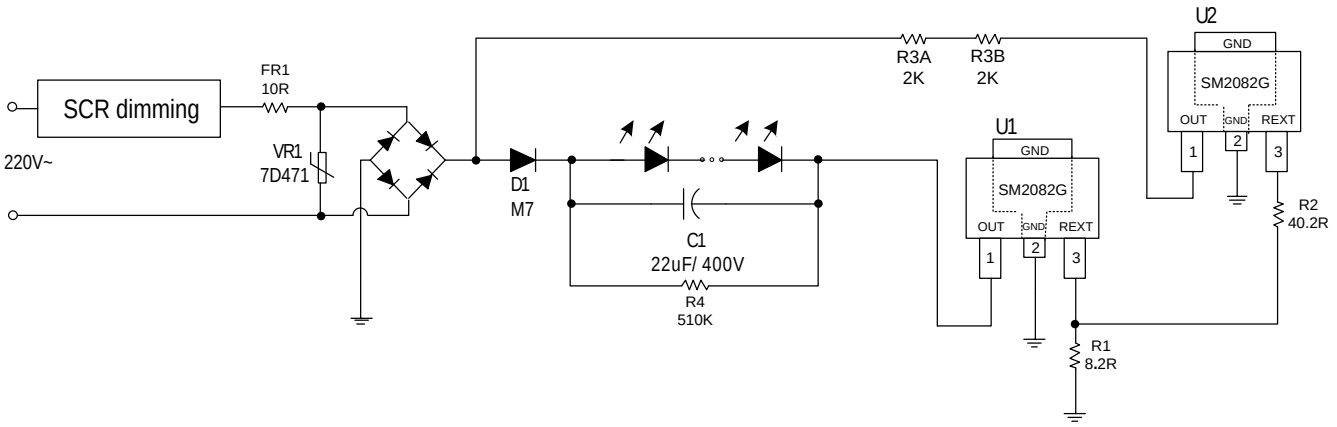
1. The system will achive optimization when the voltage of LED lights series between 250V and 270V.
2. Output current change by R1 value.
3. Recommended to use C2 for anti-jamming device.

- TO-252 No flicker Application: 16W



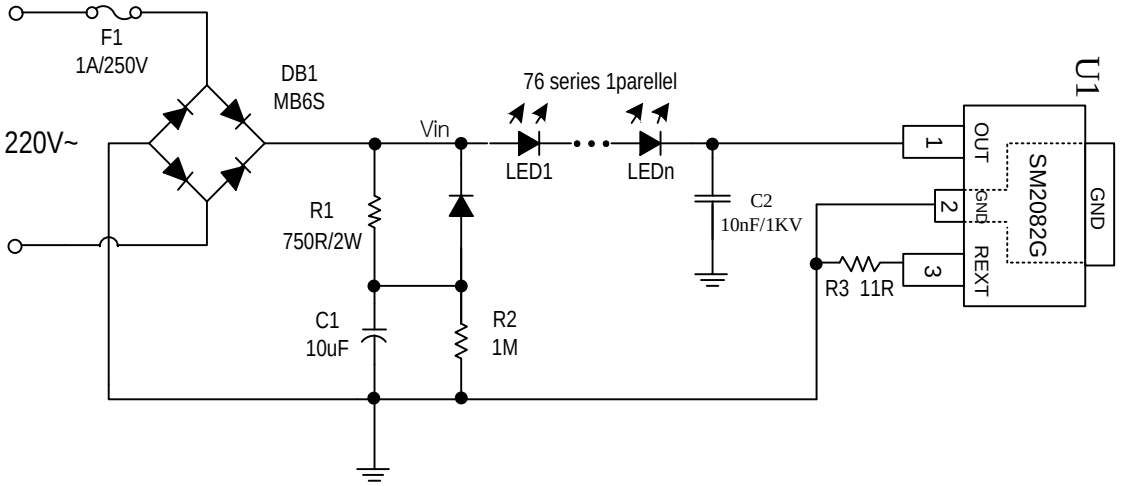
1. The system will achive optimization when the voltage of LED lights series between 250V and 270V.
2. Output current change by R1 value.
3. The value of R2 suggested between 510K and 1M for discharging resistance.
4. Recommended to use C2 for anti-jamming device.

- TO-252 SCR dimming Application: 12W



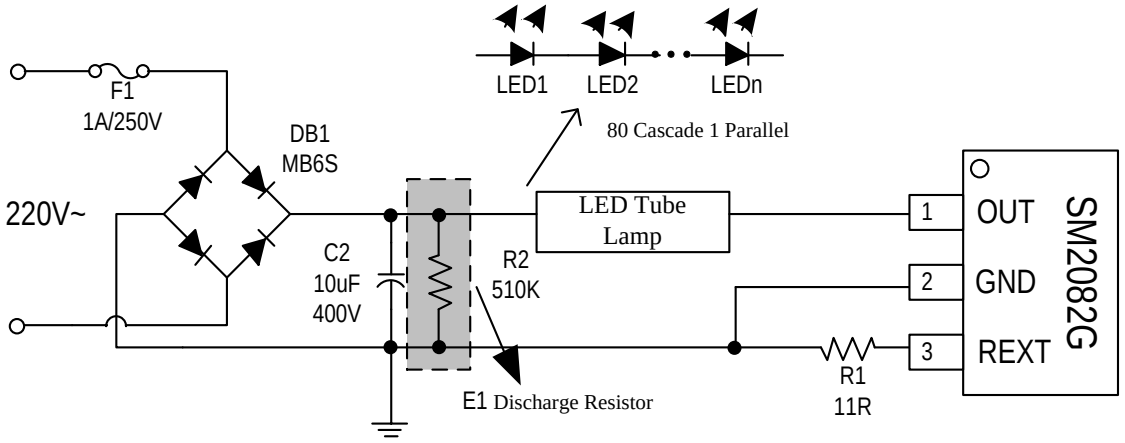
1. The system will achive optimization when the voltage of LED lights series between 230V and 250V.
2. Output current change by R1's value; Bleeder current changed by R2's value.
3. R3(AB) is a power resistance for reducing the power consumption of U2 FC2082G. It's power consumption should below 1W.
4. The value of R4 suggested between 510K and 1M fordischarging resistance.

- TO-252 Valley filling Application: 16W



1.The system will achive optimization when the voltage of LED lights series between 230V and 250V.
2.Output current change by R3's value.
3. The value of R2 suggested between 510K and 1M for discharging resistance.
4. Recommended to use C2 for anti-jamming device

Typical Application EMI Test:



EMI Test: N Line Test Report

EMI TEST REPORT

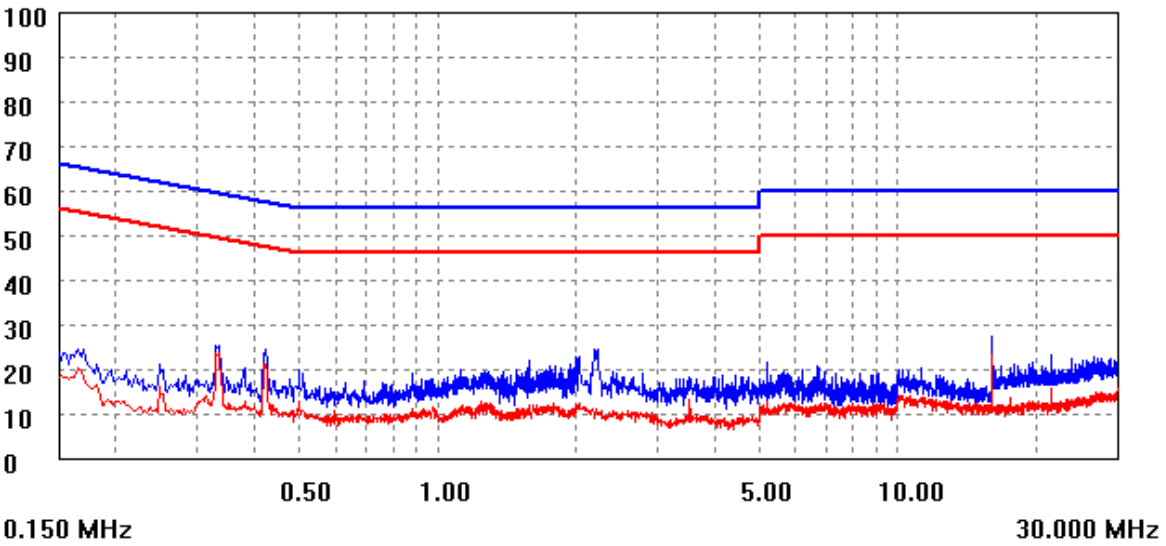
parameter

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



EMI Test: L Line Test Report

EMI TEST REPORT

parameter

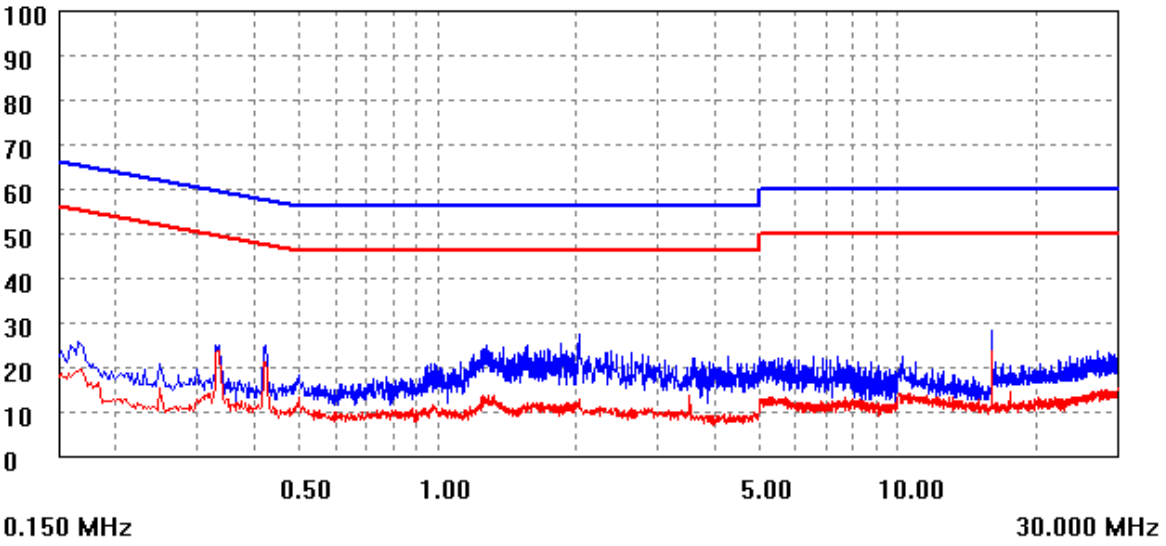
Organization:	MW	Operator:	ZXA	EUT:	
Place:		Time:	2013/6/18/14:20	Test equipment:	KH3935
Detector:	PK+AV	Test-time(ms):	20	SN:	1135217
Limit:	EN55015	Transductor(PK/AV):	PK-1 / AV-1		
Remark:					

freq, step

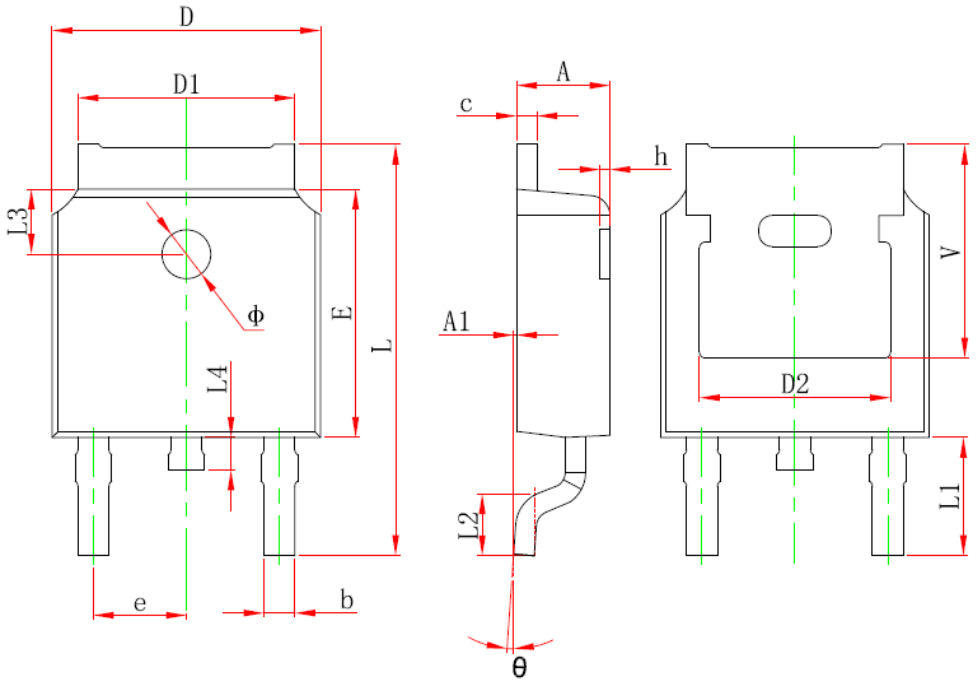
Start(MHz)	End(MHz)	Step(MHz)
0.150	2.000	0.002
2.000	10.000	0.010
10.000	30.000	0.025

scan result

dBuV

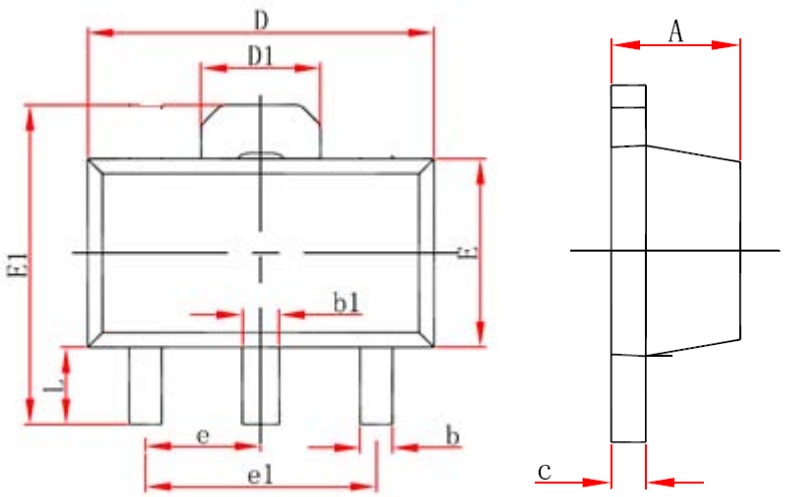


TO-252 PACKAGE



Symbol	Min(mm)	Max(mm)
A	2.0	2.7
A1	-	0.2
b	0.5	1.1
c	0.3	0.8
D	6.3	6.9
D1	4.9	5.7
D2	4.83(REF)	
E	5.9	6.4
e	2.086	2.486
L	9.5	10.7
L1	2.9(REF)	
L2	1.2	1.9
L3	1.6(REF)	
L4	0.4	1.2
Φ	0.9	1.5
θ	0°	10°
h	-	0.5
V	5.35(REF)	

SOT-89 PACKAGE



Symbol	Min(mm)	Max(mm)
A	1.3	1.8
b	0.2	0.7
b 1	0.25	0.75
c	0.2	0.6
D	4.3	4.8
E	2.2	2.8
E1	3.8	4.5
D1	1.55(REF)	
e	1.5(TYP)	
e 1	3.0(TYP)	
L	0.8	1.5