Single Channel Linear Constant Current LED Driver ME8608-N

Description

ME8608-N is a single channel linear constant current LED driver which integrates a 450V high-voltage MOSFET inside. The output current can be accurately set by RSET. The chip can be used to drive LED strips supplied by commercial power. The system is simple with few peripheral components. Thus, the cost is low.

ME8608-N integrates over temperature protection (OTP) function. When output voltage or current is too high, the temperature of the chip rises. The OTP function can reduce the current through LED to prevent the thermal damage.

Features

- Over temperature protection
- Ultra-fast LED start up
- Internal 450V MOSFET
- Output current can be set by RSET, range from 5mA to 100mA（ME8608K3G-N2:10mA~200mA）
- Simple external circuit
- Sharing PCB with LED
- No magnetic elements and EMI issues
- Support silicon controlled dimming

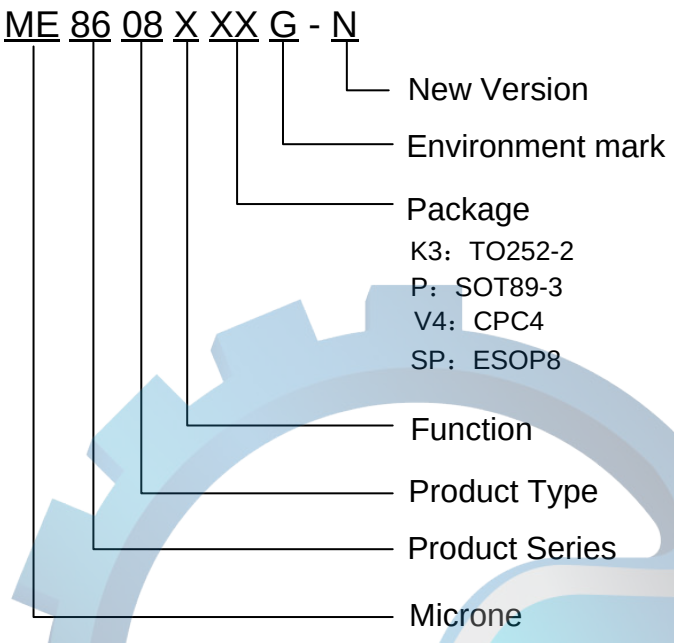
Application

- LED bulb lamp
- LED fluorescent lamp
- LED street lighting

Package

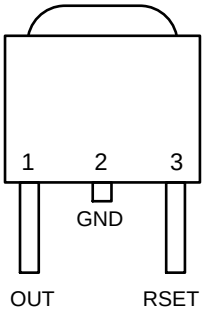
- 3-pin TO252-2、SOT89-3
- 4-pin CPC4
- 8-pin ESOP8

Selection Guide

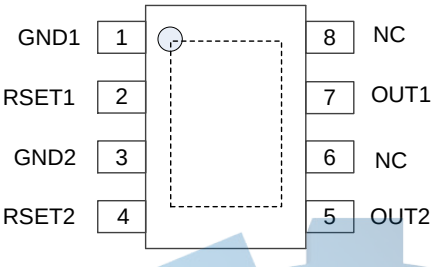


Product Series	Product Description
ME8608BK3G-N	OTP: 130℃; Package:TO252-2(single die)
ME8608BK3G-N2	OTP: 130℃; Package:TO252-2(double dies)
ME8608BPG-N	OTP: 130℃; Package:SOT89-3(single die)
ME8608BV4G-N	OTP: 130℃; Package:CPC4(single die)
ME8608BSPG-N	OTP: 130℃; Package:ESOP8 (double dies)
ME8608BDSPG-N	OTP: 130℃; Package:ESOP8 (single die)
ME8608CK3G-N	OTP: 150℃; Package:TO252-2(single die)
ME8608CK3G-N2	OTP: 150℃; Package:TO252-2(double dies)
ME8608CPG-N	OTP: 150℃; Package:SOT89-3(single die)
ME8608CV4G-N	OTP: 150℃; Package:CPC4(single die)
ME8608CDSPG-N	OTP: 150℃; Package:ESOP8(single die)

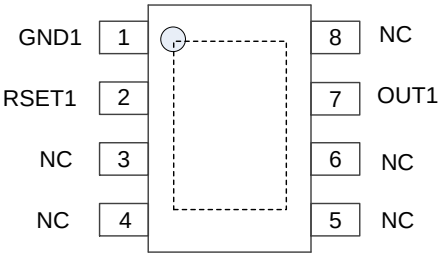
Pin Configuration



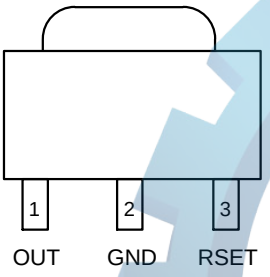
TO252-2



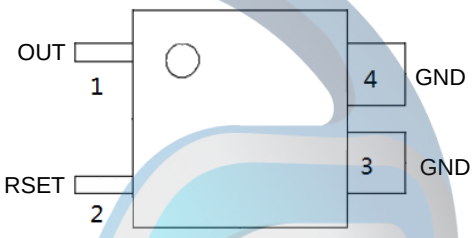
ESOP8(double dies)



ESOP8(single die)



SOT89-3



CPC4

Pin Assignment

Number（TO252-2）	Number（SOT89-3）	Number（CPC4）	Symbol	Function
1	1	1	OUT	Connect to LED lamps, voltage input and constant current output
2	2	3、4	GND	Ground
3	3	2	RSET	Output current setting pin, connect to Ground with a resistor

Number（ESOP8 double dies）	Number（ESOP8 single die）	Symbol	Function
1	1	GND1	Ground
2	2	RSET1	Output current setting pin, connect to Ground with a resistor
3		GND2	Ground
4		RSET2	Output current setting pin, connect to Ground with a resistor
5		OUT2	Connect to LED lamps, voltage input and constant current output
6、8	3、4、5、6、8	NC	
7	7	OUT1	Connect to LED lamps, voltage input and constant current output

Functional Block Diagram

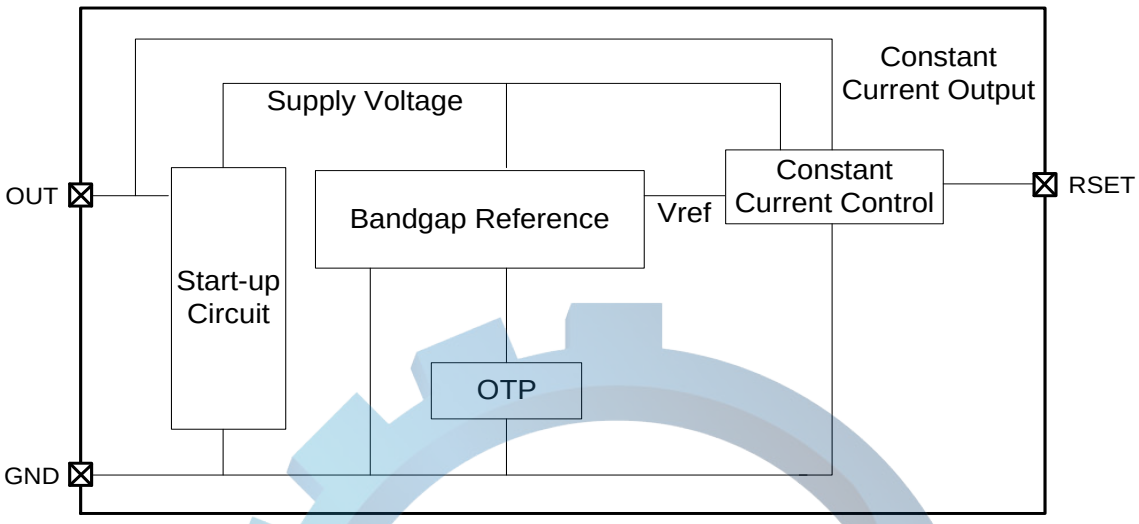


Figure 1. Functional Block Diagram of ME8608-N

Absolute Maximum Ratings (1)

Parameter		Value	Unit
Voltage at OUT：V_{OUT}		-0.5~450	V
Current at OUT：I_{OUT}		5~100	mA
		10~200（ME8608K3G-N2）	
Operating Ambient Temperature		-40~+85	ºC
Storage Temperature		-55~+150	ºC
Maximum junction temperature		-40~+150	ºC
Thermal resistor (2)：θ_{JA}	TO252-2	55	ºC/W
	SOT89-3	100	ºC/W
	CPC4	190	ºC/W
	ESOP8	63	ºC/W
Continuous Total Power Dissipation P_D	TO252-2	2.25	W
	SOT89-3	1.25	W
	CPC4	0.66	W
	ESOP8	1.98	W

Note：（1）Stresses greater than those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These values must therefore not be exceeded under any conditions.

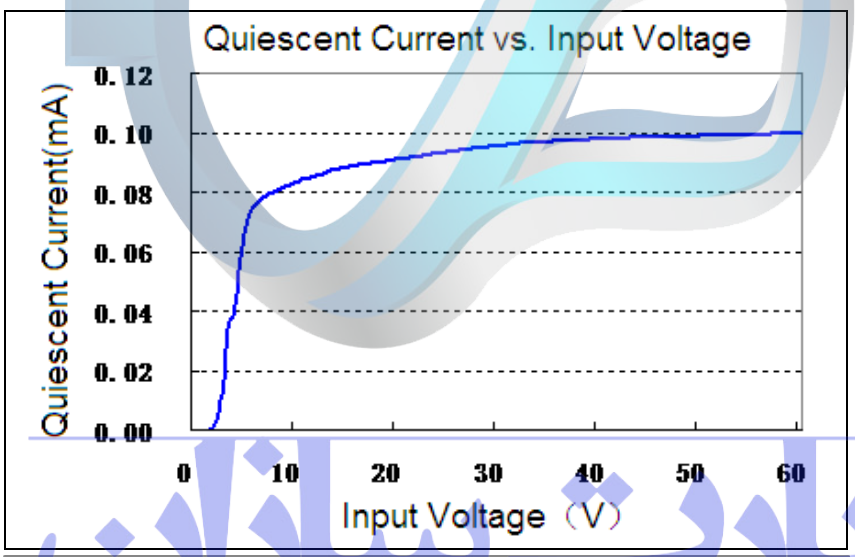
（2）ME8608-N needs to be connected to the PCB with at least 200mm² cooling copper foil, the thickness of the copper foil is 35μm.

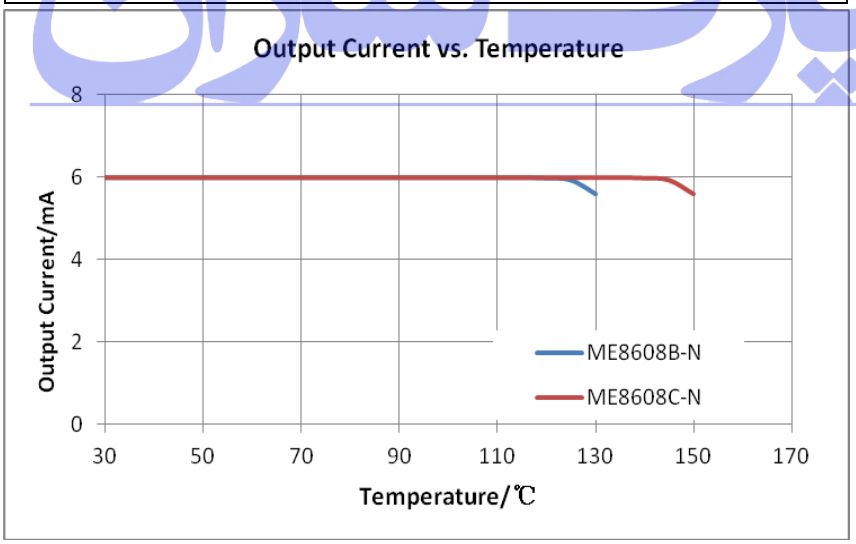
Electrical Characteristics（T_A=25℃, unless otherwise specified）

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
V_{OUT}	Input voltage of OUT	I_{OUT} =6mA	7.5	-	-	V
V_{OUT-BV}	Break Down Voltage	RSET is opened	-	450	-	V
I_{OUT}	Output Current（1）	V_{OUT} =10V	5	-	100	mA
		V_{OUT} =20V(ME8608K3G-N2)	10	-	200	mA
I_{DD}	Quiescent Current	RSET is opened(single die)	-	0.1	-	mA
		RSET is opened(double dies)	-	0.2	-	mA
V_{RSET}	Voltage of RSET	V_{OUT} =20V，I_{OUT} =6mA	-	0.6	-	V
D_{IOUT}	Deviation of I_{OUT} among chips	I_{OUT} =6mA	-	±4	-	%
T_{sc}	Initial point of negative Temperature compensation	I_{OUT} =6mA(ME8608B-N)	-	130	-	ºC
		I_{OUT} =6mA(ME8608C-N)	-	150	-	ºC

Note：（1）P_{max} is the maximum power under good heat dissipation condition.

Typical Performance Characteristic





Temperature Compensation

If the temperature of LED lamp is too high, the life span of LED will decrease. ME8608-N integrates temperature compensation. When the interior temperature of the chip exceeds 130℃(ME8608B-N), the output current will decrease automatically to lower down the internal temperature of LED lamp.

Operation Description

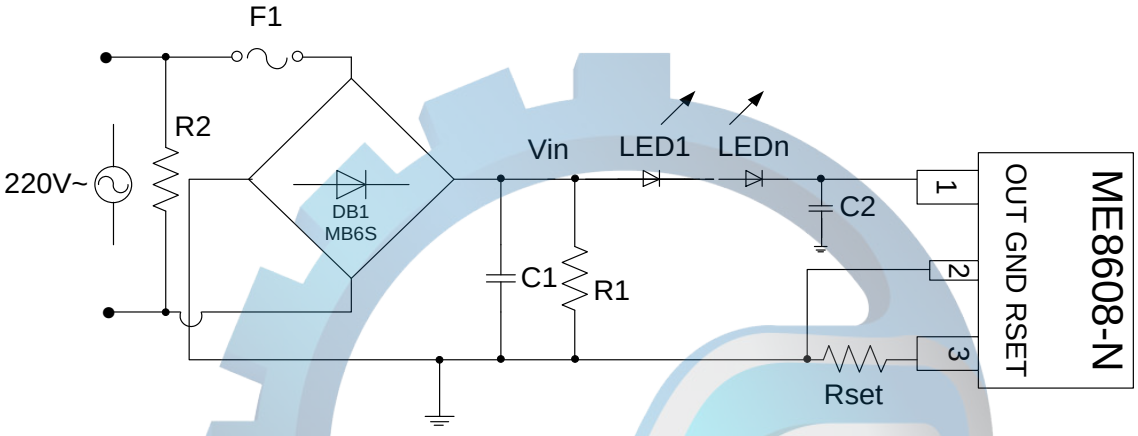


Figure 2. The Principle of Application

Calculation of Output Current

The output current I_{OUT} is determined by the resistor between RSET and GND, the formula is shown as below:

$$I_{OUT} = \frac{V_{SET}}{R_{SET}}$$

V_{SET} is the voltage between RSET and GND.

Theory of Efficiency Design

The efficiency of the circuit can be obtained as below:

$$\eta = \frac{P_{LED}}{P_{in}} = \frac{n*V_{LED}*I_{LED}}{V_{in}*I_{LED}} = \frac{n*V_{LED}}{V_{in}} = \frac{V_{in} - V_{OUT}}{V_{in}}$$

The voltage of OUT is determined by the number of cascaded LED lamps and Vin, VOUT=Vin-nVLED. VLED is the voltage drop of a single LED, Vin is the input voltage of the system. From the formula above, we know that with the increase number of LED lamps, VOUT decreases and the efficiency increases. In the system design, we need to optimize the efficiency performance by adjust the voltage of OUT.

Selection of Number of LED Lamps

The voltage of OUT should be larger than V_{OUT_MIN} to make sure the chip operates properly. The range of V_{OUT} is V_{OUT_MIN}~V_{OUT_MAX}, the number of cascaded LED lamps range from $\frac{V_{in} - V_{OUT\_MAX}}{V_{LED}}$ to $\frac{V_{in} - V_{OUT\_MIN}}{V_{LED}}$.

Selection of Capacitor and Resistor

C1 is electrolytic capacitor; C2 is anti-interference device, which is optional, the recommended value is

10nF/10KV; R1 is the discharging resistor of the system, the recommended range is 510KΩ~1MΩ; R2 is a varistor to prevent surge damage to the chip. Recommended model 7D741.

C1 can reduce the ripple voltage of Vin, the larger the C2, the smaller the ripple of Vin and the ripple of the voltage of OUT is smaller too. C1 is related to the total current flows through the LED lamps, typical range of C1 is 4.7uF/400V~22uF/400V and the formula is shown as below:

$$C_1 = \frac{I_{LED} \times t}{\Delta V}$$

I_{LED} is the current through LED lamps, which equals to output current I_{OUT}; When the frequency of AC power supply is 50Hz, $t = \frac{1}{4} \times \frac{1}{f} = 5ms$; ΔV is the ripple voltage of OUT.

Typical Application Circuit

Single Chip Application: 8W

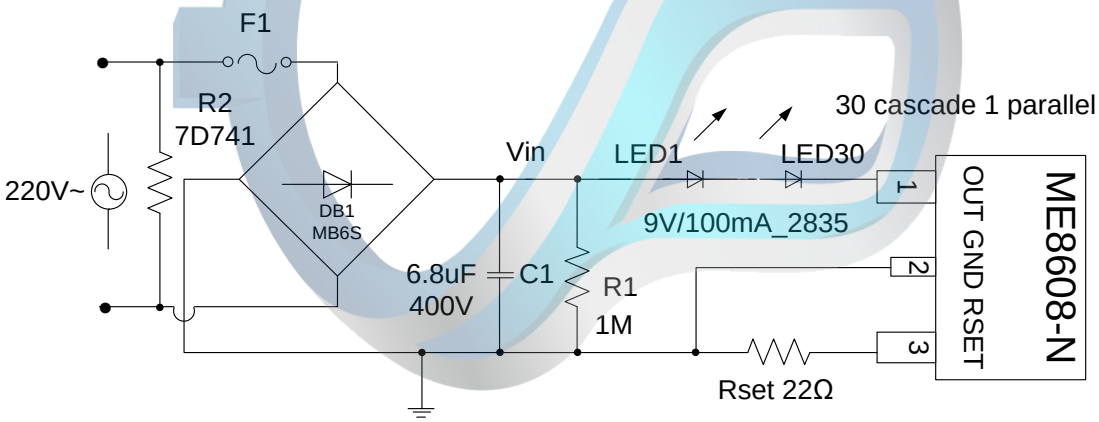


Figure 3. Single Chip Application

The input AC supply voltage range from 200V to 240V; 30 cascaded 9V LED lamps; Rset is 22Ω.

Application with Valley Fill Circuit: 8W

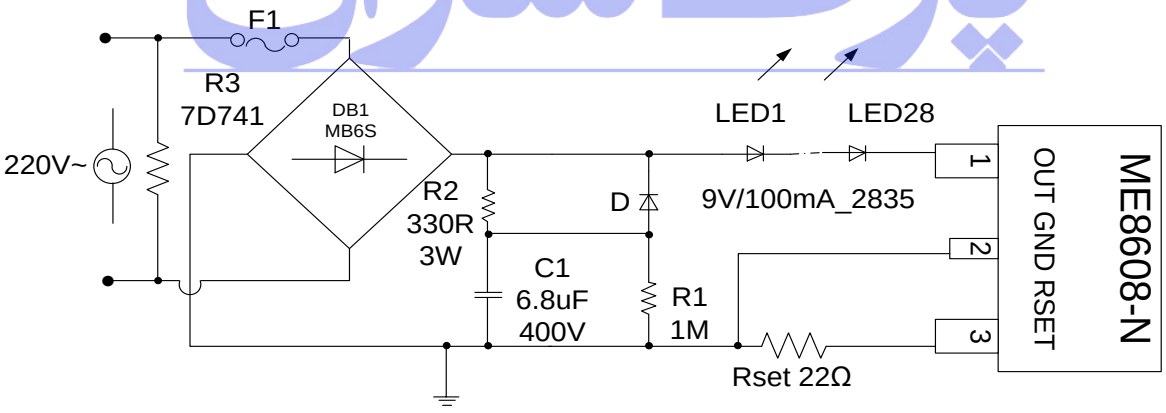


Figure 4. Application with Valley Fill Circuit: 8W

The input AC supply voltage range from 200V to 240V; 28 cascaded 9V LED lamps; Rset is 22Ω.

Double Chip Application: 16W (ESOP8 double dies)

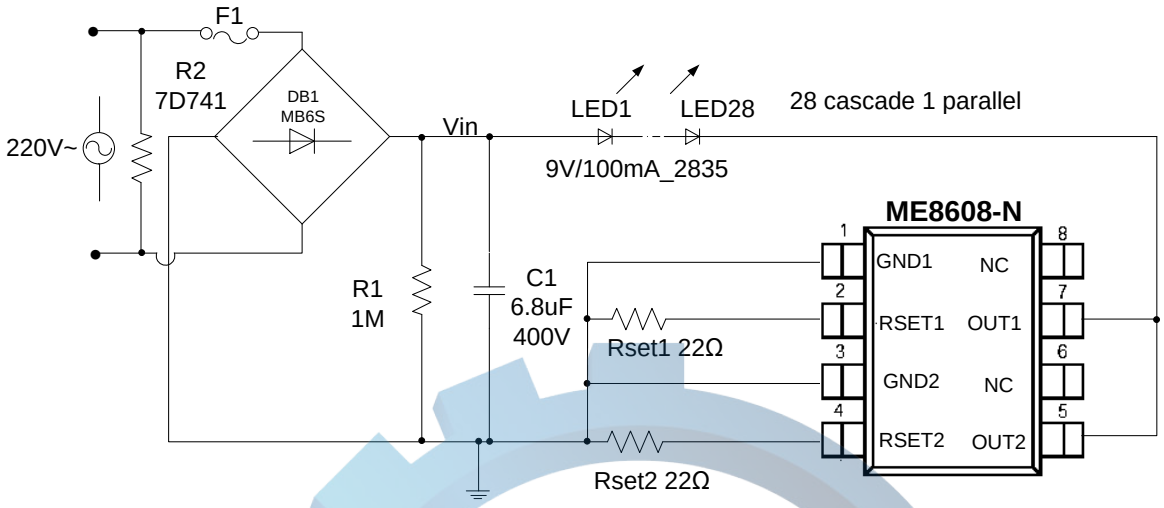


Figure 5. Double Chip Application: 16W

The input AC supply voltage range from 200V to 240V; 28 cascaded 9V LED lamps; Rset1 and Rset2 are both 22Ω.

PCB Layout

When designing the PCB, please follow the guidelines showed as below to optimize performance:

（1）Aluminum base board is preferred to achieve better thermal performance.

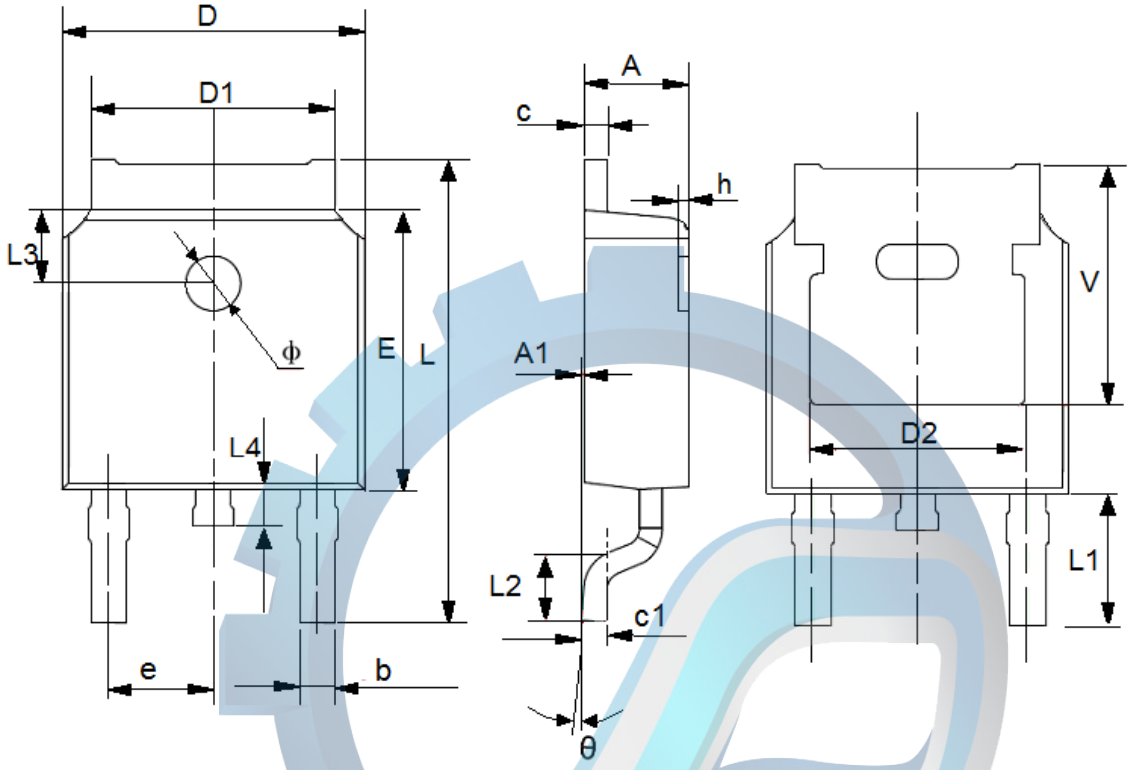
（2）The connection of the power ground of the resistor Rset should be as shorter as possible to reduce the effect of parasitic resistor, which will decrease the error of output current.

（3）Heat sink is on the bottom of ME8608-N, connected to GND of the chip internally. The heat sink should be connected to the ground of PCB; it is recommended that the chip should be connected to PCB with at least 200mm² cooling copper foil, the thickness of the copper foil is 35μm.

（4）The MR8608-N series is a linear drive scheme with internal thermal feedback adjustment, so the maximum drive current capability is directly related to the heat dissipation of the solution. In the case of good heat dissipation, the ME8608K3G-N2 series can reach 120mA current.

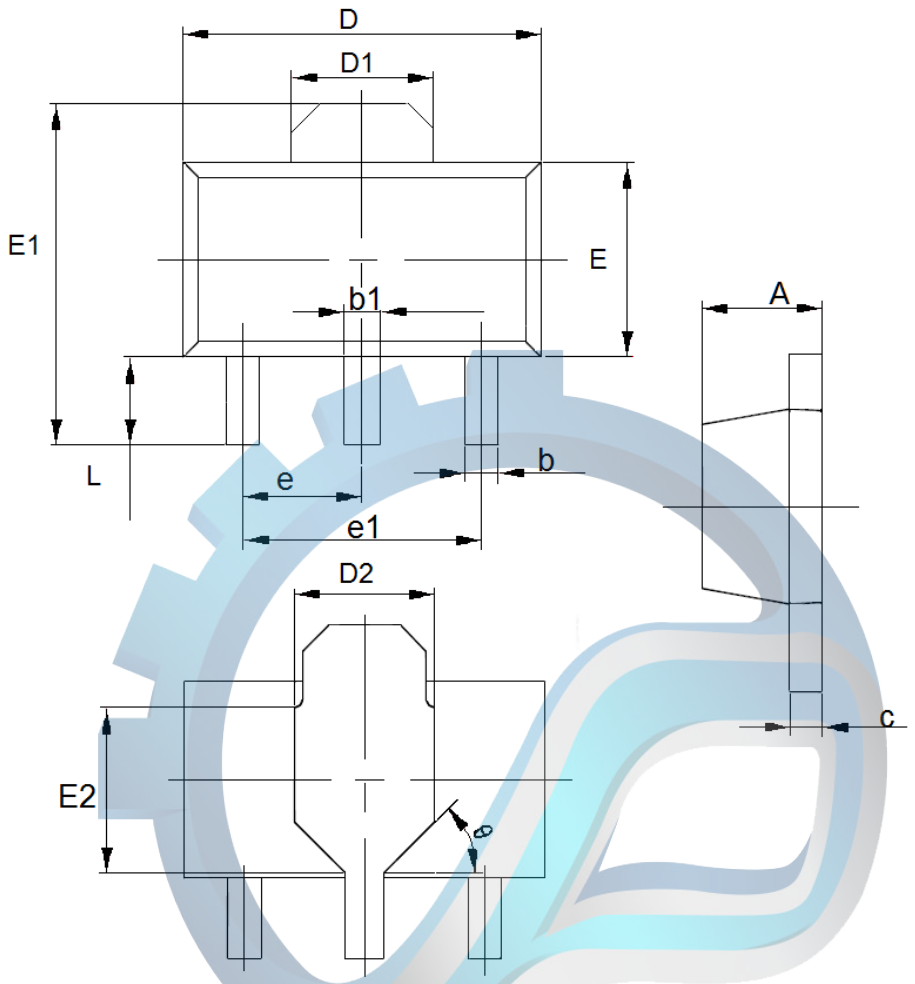
Package Information

- **Package Type: TO252-2**



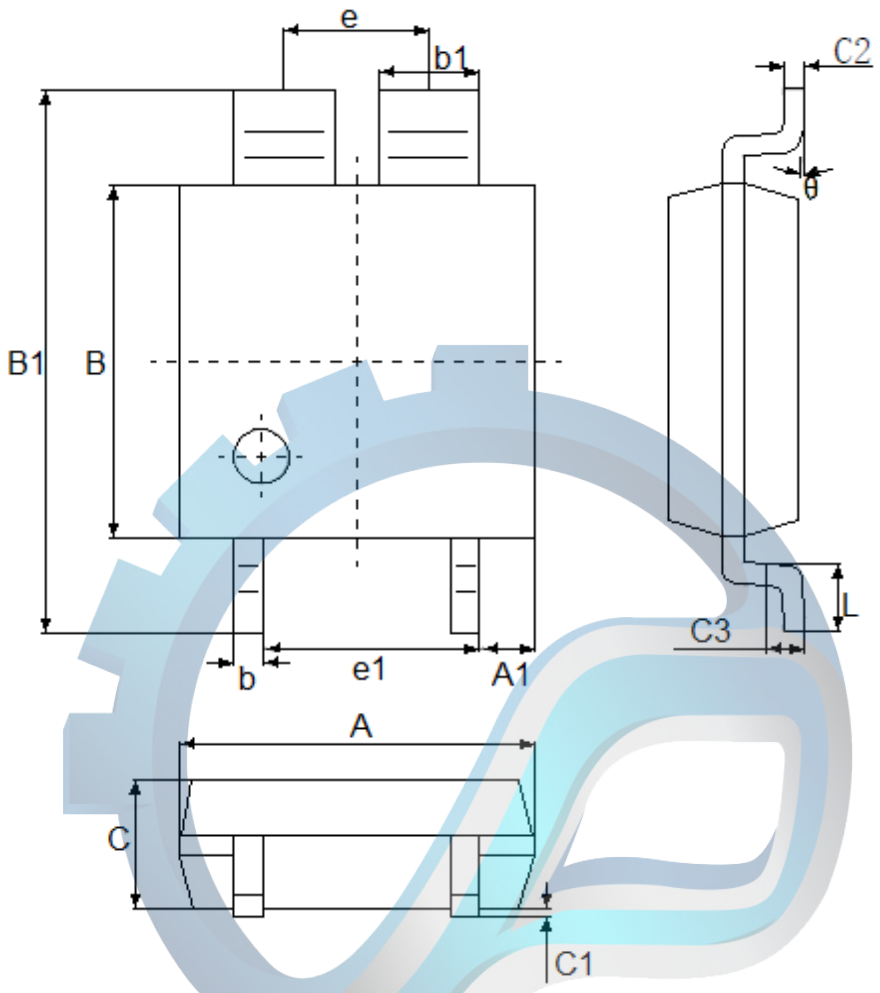
DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	2.2	2.4	0.0866	0.0945
A1	0	0.127	0	0.005
b	0.66	0.86	0.026	0.0339
c	0.46	0.58	0.0181	0.0228
c1	0.498	0.6	0.0196	0.0236
D	6.5	6.7	0.2559	0.2638
D1	5.33(TYP)		0.2098(TYP)	
D2	4.83(TYP)		0.1902(TYP)	
E	6	6.2	0.2362	0.2441
e	2.286(TYP)		0.09(TYP)	
L	9.8	10.4	0.3858	0.4094
L1	2.9(TYP)		0.1142(TYP)	
L2	1.4	1.7	0.0551	0.0669
L3	1.8(TYP)		0.0708(TYP)	
L4	0.6	1	0.0236	0.0394
h	0	0.3	0	0.0118
Φ	1.1	1.3	0.0433	0.0512
V	5.3(TYP)		0.2087(TYP)	
θ	0	8°	0	8°

- **Package Type: SOT89-3**



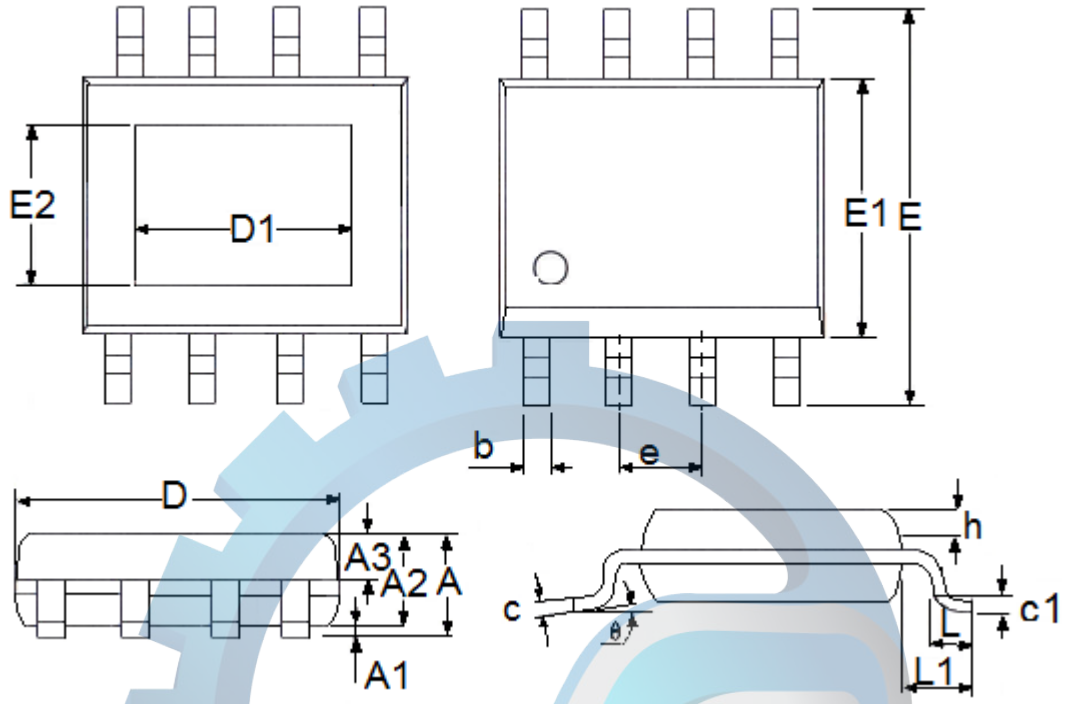
DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	1.4	1.6	0.0551	0.0630
b	0.32	0.52	0.0126	0.0205
b1	0.4	0.58	0.0157	0.0228
c	0.35	0.45	0.0138	0.0177
D	4.4	4.6	0.1732	0.1811
D1	1.55(TYP)		0.061(TYP)	
D2	1.75(TYP)		0.0689(TYP)	
e1	3.0(TYP)		0.1181(TYP)	
E	2.3	2.6	0.0906	0.1023
E1	3.94	4.4	0.1551	0.1732
E2	1.9(TYP)		0.0748(TYP)	
e	1.5(TYP)		0.0591(TYP)	
L	0.8	1.2	0.0315	0.0472
θ	45°		45°	

- **Package Type: CPC4**



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	2.5	2.7	0.0984	0.1063
A1	0.35	0.45	0.01378	0.0177
e	1.06 (TYP)		0.0417 (TYP)	
e1	1.59 (TYP)		0.0626 (TYP)	
B	2.5	2.7	0.0984	0.1063
B1	3.8	4.2	0.1496	0.1654
b	0.16	0.26	0.0063	0.0102
b1	0.69	0.8	0.0272	0.0315
C	0.8	1.1	0.0315	0.0433
C1	0	0.15	0	0.0059
C2	0.15	0.18	0.0059	0.0071
C3	0.25(TYP)		0.0098(TYP)	
L	0.4	0.6	0.0157	0.0236
θ	0°	8°	0°	8°

- **Package Type: ESOP8**



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	1.3	1.75	0.0512	0.0689
A1	0	0.2	0.0000	0.0079
A2	1.25	1.65	0.0492	0.0650
A3	0.5	0.7	0.0197	0.0276
b	0.33	0.51	0.0130	0.0201
c	0.17	0.25	0.0067	0.0098
D	4.7	5.1	0.1850	0.2008
E	5.8	6.2	0.2283	0.2441
E1	3.8	4	0.1496	0.1575
e	1.27(TYP)		0.05(TYP)	
h	0.25	0.5	0.0098	0.0197
L	0.4	1.27	0.0157	0.0500
L1	1.04(TYP)		0.0409(TYP)	
θ	0	8°	0.0000	8°
c1	0.25(TYP)		0.0098(TYP)	
D1	3.1(TYP)		0.122(TYP)	
E2	2.21(TYP)		0.087(TYP)	

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