



1 Watt Step up DC-DC White LED Driver ME2106 Series

General Description

ME2106 Series is a PFM Step-up DC/DC driver IC with invariant current, design for LED applications. Thought the external resistance, output current reach 0mA~500mA.

A low ripple, high efficiency step-up DC/DC converter can be constructed of ME2106xx with only three external components. Also available is a CE (chip enable) function that reduce power consumption.

Typical Application

- Power source for high-power LED
- Power source for invariant current

Features

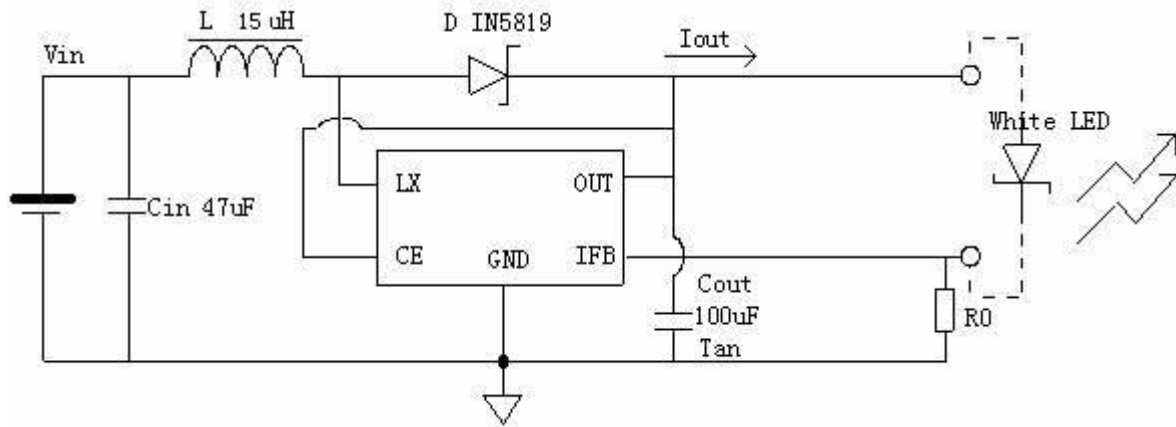
- Low start voltage: 0.8V (at I_{out}=1mA)
- Output Current range: 0~ 500mA
- Output Current accuracy: ±10%
- Only inductors, capacitors, schottky diodes, resistors and so few external components
- High Efficiency: 82%(Type)

Package

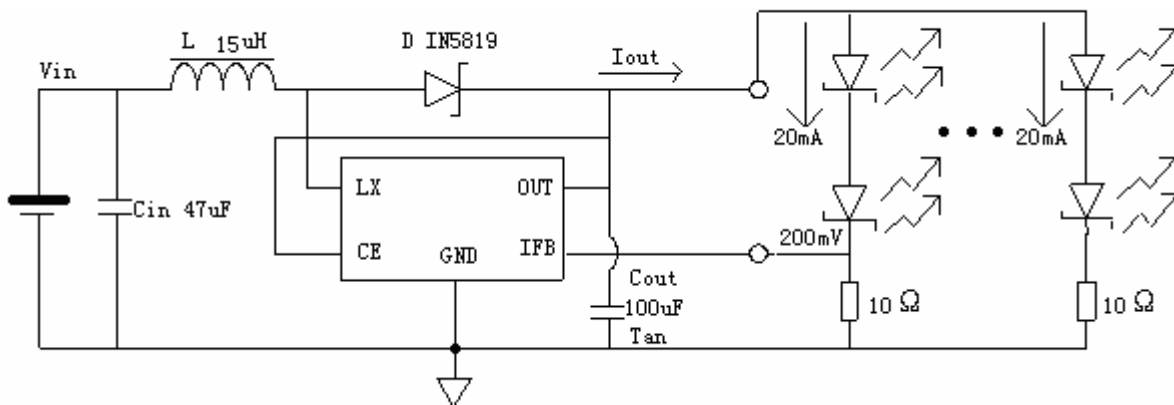
- 5-pin SOT-23-5、SOT-89-5

Typical Application Circuit

Application of constant current output



(A) Drive one white light LED with 1W

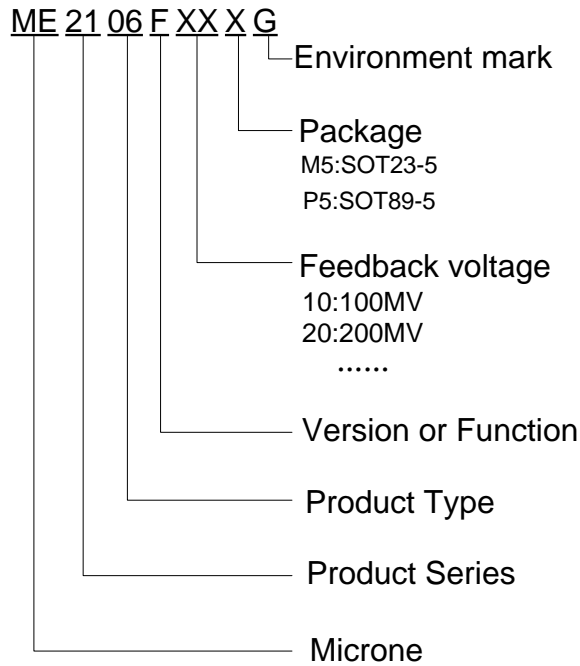


(B) Drive more serial two parallel white light LED with low power

Suggestions:

- You can increase the output capacitor properly for improve to the characteristic of the output invariant current (for example: 150uF or 200uF)。
- To avoid the feedback voltage excursion, please wear the ring with static electricity and the electric iron connect to ground when the soldering。

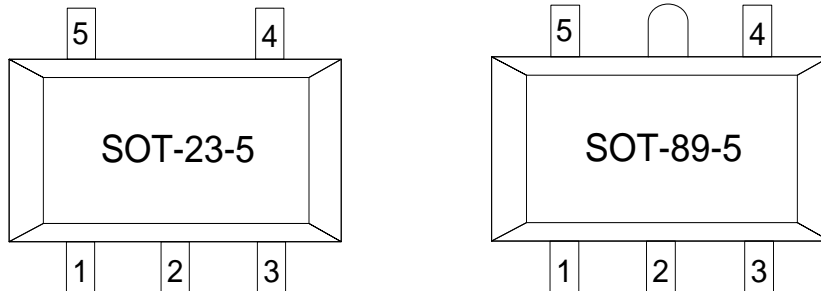
Selection Guide



| product series | product description |
|----------------|---|
| ME2106F20M5G | Feedback voltage: 200mV; Package: SOT23-5 |
| ME2106F20P5G | Feedback voltage: 200mV; Package: SOT89-5 |
| ME2106F10P5G | Feedback voltage: 100mV; Package: SOT89-5 |

NOTE: If you need other voltage and package, please contact our sales staff.

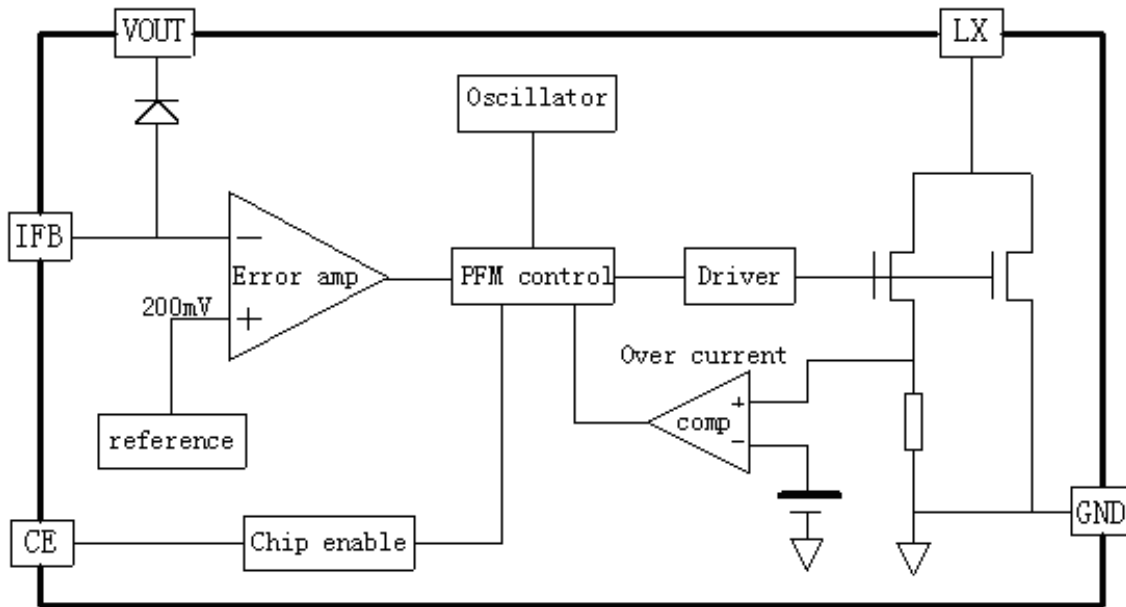
Pin Configuration & Pin Assignment



Pin Assignment

| PIN Number | | PIN NAME | FUNCTION |
|------------|----------|----------|--|
| SOT-23-5 | SOT-89-5 | | |
| 1 | 3 | CE | Chip enable |
| 2 | 2 | Vout | Output voltage monitor, IC internal power supply |
| 3 | 1 | FB | Feedback |
| 4 | 5 | GND | Ground |
| 5 | 4 | Lx | Switch |

Block Diagram



Absolute Maximum Ratings

| PARAMETER | SYMBOL | RATINGS | UNITS |
|---------------------------------------|--------------|--------------|-------|
| V_{IN} Input Voltage | V_{IN} | 0.3~6.5 | V |
| Lx Pin voltage | V_{LX} | 0.3~Vout+0.3 | V |
| CE Pin voltage | V_{CE} | 0.3~Vout+0.3 | V |
| IFB output voltage | V_{IFB} | 0.3~Vout+0.3 | V |
| Lx Pin current | I_{LX} | 1.5 | A |
| Continuous Total Power Dissipation | SOT-23-5 | P_d | 300 |
| | SOT-89-5 | P_d | 500 |
| Maximum Operating Ambient Temperature | T_{max} | 150 | °C |
| Operating Ambient Temperature | T_{Opr} | -20~+85 | °C |
| Storage Temperature | T_{stg} | -40~+125 | °C |
| Soldering temperature and time | T_{solder} | 260°C, 10s | |

Recommend work conditions

| PARAMETER | MIN | RECOMMEND | MAX | UNITS |
|-------------------------------|-----|-----------|------|-------|
| Input voltage | 0.8 | | Vout | V |
| Inductance | 10 | 15 | 100 | μH |
| Input inductance | 0 | ≥22 | | μF |
| output inductance | 47 | 100 | 220 | μF |
| Operating Ambient Temperature | -20 | | 85 | °C |

Electrical Characteristics

(Measuring conditions: $V_{IN}=2.5V$, $V_{CE}=V_{OUT}=3.3V$, $R=33\Omega$, $T_A=25^\circ C$. Unless otherwise specified)

| SYMBOL | PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|--------------|-------------------------|---|-----|-----|-----|---------|
| V_{OUT} | feedback Voltage | $I_{OUT}=100mA$ | 180 | 200 | 220 | mV |
| V_{start} | Starup Voltage | $I_{OUT}=1mA$, $V_{IN}: 0 \rightarrow 2V$ | | 0.8 | 0.9 | V |
| V_{hold} | holding Voltage | $I_{OUT}=1mA$, $V_{IN}: 2 \rightarrow 0V$ | 0.6 | 0.7 | | V |
| I_{DD2} | Supply Current | $V_{CE}=V_{IFB}=V_{OUT}=3.3V$ | | | 50 | μA |
| I_{LXleak} | Lx Leakage Current | $V_{CE}=V_{LX}=V_{OUT}=V_{IFB}=3.3V$ | | | 1 | μA |
| F_{osc} | Oscillation Frequency | $V_{IFB}=0$ | | 300 | | kHz |
| Maxdty | Duty Ratio | On(V_{LX} "L")side | 77 | 79 | 82 | % |
| η | Efficiency | $I_{OUT}=250mA$ | | 82 | | % |
| V_{CEH} | CE is "H",input voltage | $V_{CE}: 0 \rightarrow 2V$ (up to work slowly with the chip) | 0.6 | | | V |
| V_{CEL} | CE is "L",input voltage | $V_{CE}: 2V \rightarrow 0$ (down to work off slowly with the chip) | | | 0.4 | V |

Notes:

- 1、Diode: Schottky diode (forward voltage drop : 0.3V, 0.3A), such as 1N5817 or 1N5819
- 2、Inductor: 15 μ H ($R<0.5\Omega$)
- 3、Capacitor: 100 μ F (Tantalum type)
- 4、 V_{IFB} (SET) is feedback voltage of the chip set up , is the first parameter of the table ,such as 200mV 。

Operation

ME2106 is a DC/DC step-up converter with voltage type , PFM control mode , output invariableness current. It has only three Peripheral components that is a inductor 、 a output capacitor、 a schottky diode and a resistor with set-up output current, that can afford to a invariant output current between 0 and 500mA .Rc set-up method: If the output current is Iout, that

$$Rc = \frac{V_{IFB}}{I_{out}}$$

For example,want to the current value of 100mA,select the chip of $V_{IFB}=200mV$,that $Rc=200mV/100mA=2\Omega$ 。

Selection of Peripheral Components and Application Notes

Sum up , inductor , schottky diode would be affect the switching efficiency , capacitor and inductor would be affect the output ripple. Choose such an inductor, capacitor, schottky diode that have high switching efficiency, low ripple, low noises.

Before discussion, define to $D \equiv \frac{V_{out} - V_{in}}{V_{out}}$ 。

➤ selection of inductor

Make sure DC-DC can natural work firstly in the model of the minimum continuous current that is Lmin,

$$L_{min} \geq \frac{D(1-D)^2 R_L}{2f}$$

This formula deduce that ignoring the autoecious resistor and a diode with the forward voltage drop, but the actual value is still big. If the inductance less than Lmin, inductor will reach magnetic saturation, efficiency will greatly drop, and hardly output steady voltage.

Secondly, considering the current ripple of the inductor, ignoring the autoecious parameter in the mode of continuous current.

$$\Delta I = \frac{D \cdot V_{in}}{L_f}, \quad I_{max} = \frac{V_{in}}{(1-D)^2 R_L} + \frac{D V_{in}}{2 L_f} .$$

When “L” is too small, will lead to high current ripple of the inductor , and the maximum current of the inductor , schottky diode , power tube of the chip are excessive .

Thirdly, generally speaking, not considering efficiency , small inductor can drive load more then large inductor .But in the same load conditions , large inductor with the current ripple and the maximum current value are small. So the large inductor should be able to start up circuit in the low input voltage.

Use inductor with an inductance of 10μH or more ,it's ensure to normal work . If output port has load with output large current (for example: output current is more than 50mA), for improving to efficiency, suggest to use large inductor. At the same time, in the large load, the resistor is in series with the inductor that will affect the switching efficiency. Supposed , the resistor is rL, R_{load}, that the power consumption as follow:

$$\Delta \eta \approx \frac{r_L}{R_{load}(1-D)^2}$$

For example, input 1.5V, output 3.0V, load 20 Ω (150mA), rL=0.5Ω, efficiency loss 10% .

Considering, suggest to use an inductance of 15 uH , rL<0.5Ω.

➤ selection of capacitor

No considering the inductor with equivalent series resistor(ESR), output voltage ripple is:

$$r = \frac{\Delta V_{out}}{V_{out}} = \frac{D}{R_{load} C_f}$$

considering the inductor's ESR, the output ripple will be increase: $r' = r + \frac{I_{max} \cdot R_{ESR}}{V_{out}}$

Suggest to use Tantalum type with the low ESR or more parallel-resistor.

➤ selection of diode

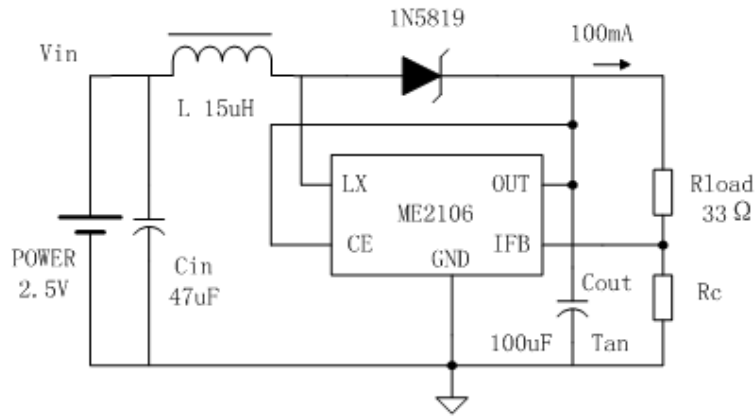
It is recommended that the diode have great effect to DC-DC efficiency, we suggest to use schottky diode with the lower positive turn-on voltage and the lower corresponsive time. For example, 1N5817、1N5819 .

➤ selection of input capacitor

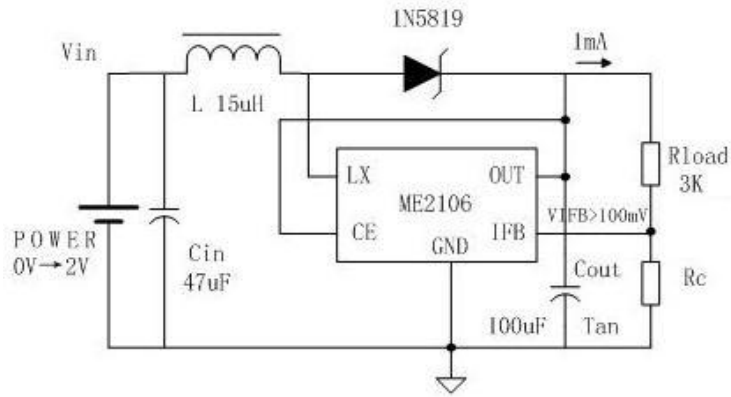
Power supply is stably, even if no input capacitor, DC-DC can output voltage with the lower ripple and the lower noise. But we suggest to connect with the capacitor of 10uF or more when the power supply was far away DC-DC, for minish the output noise.

Testing circuit:

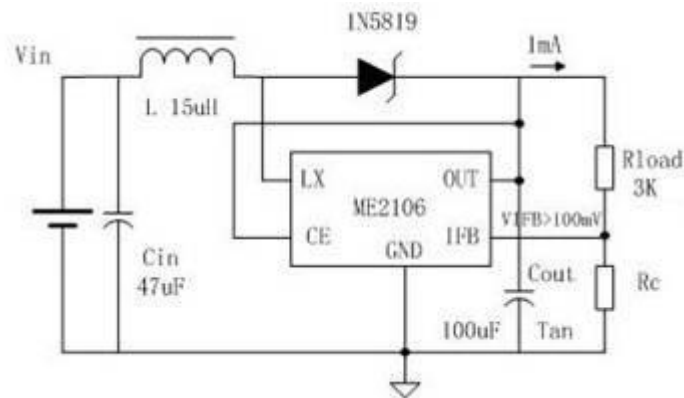
(1) Test foldback voltage



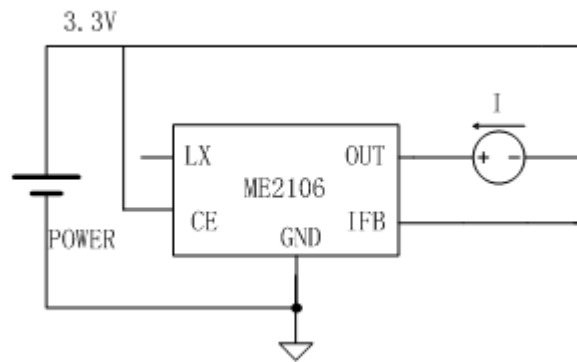
(2) Test startup voltage



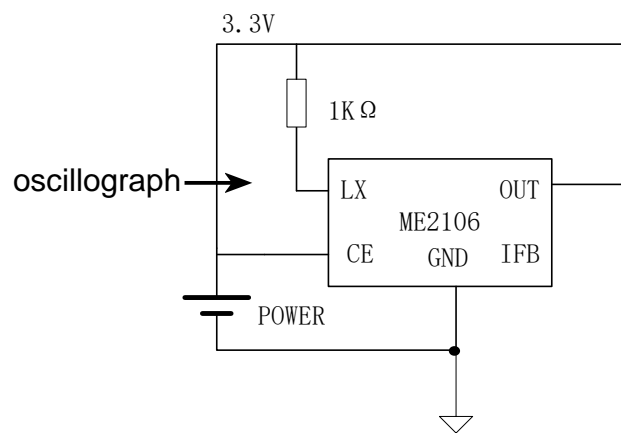
(3) Test holding voltage



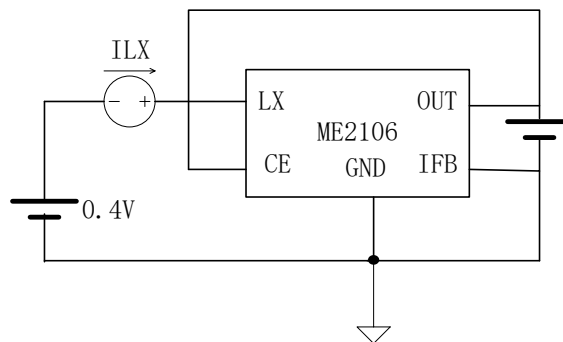
(4) Test supply current



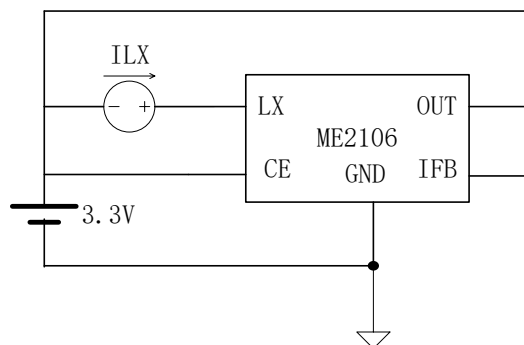
(5) Test Oscillation Frequency and Duty Ratio



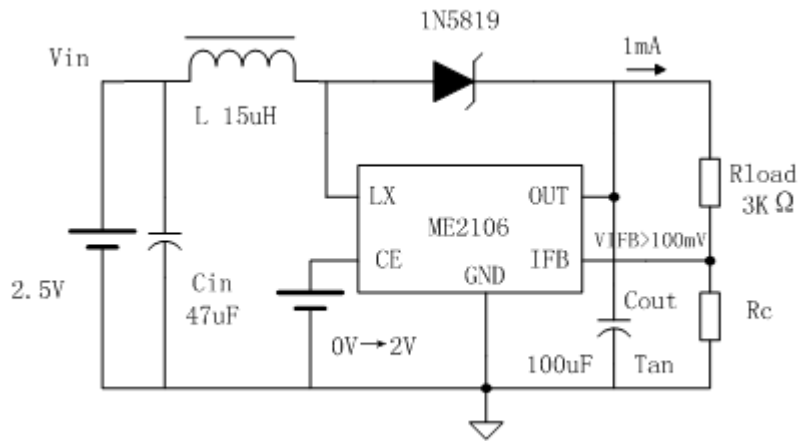
(6) Test switching current



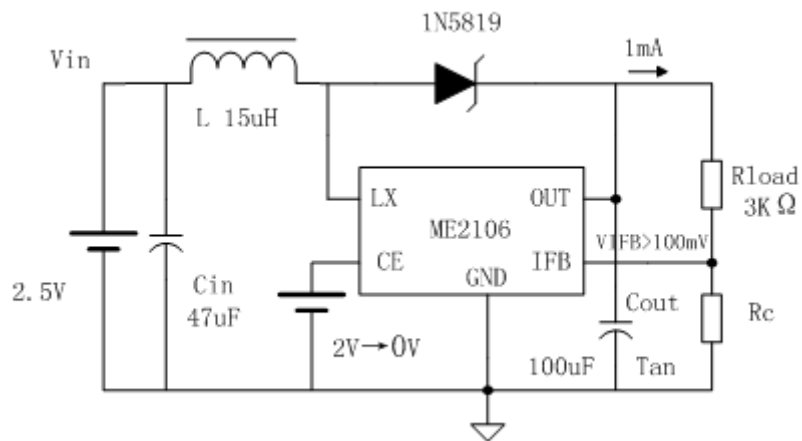
(7) Test switch leakage current



(8) Test CE high voltage

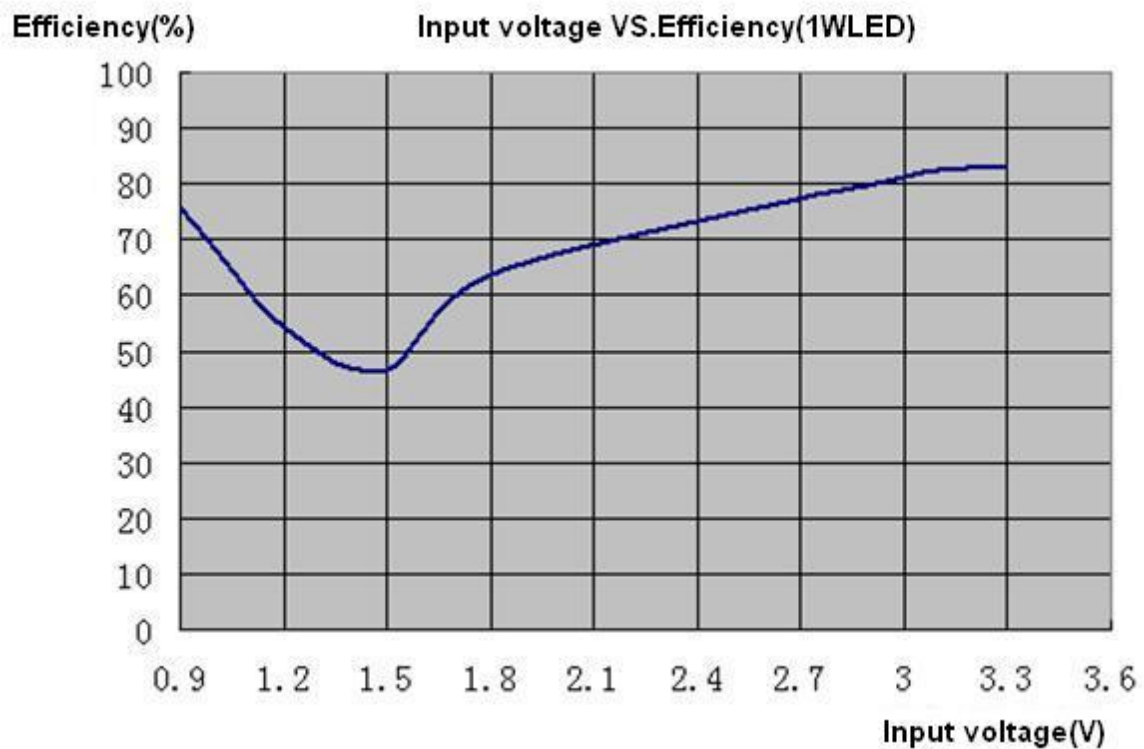
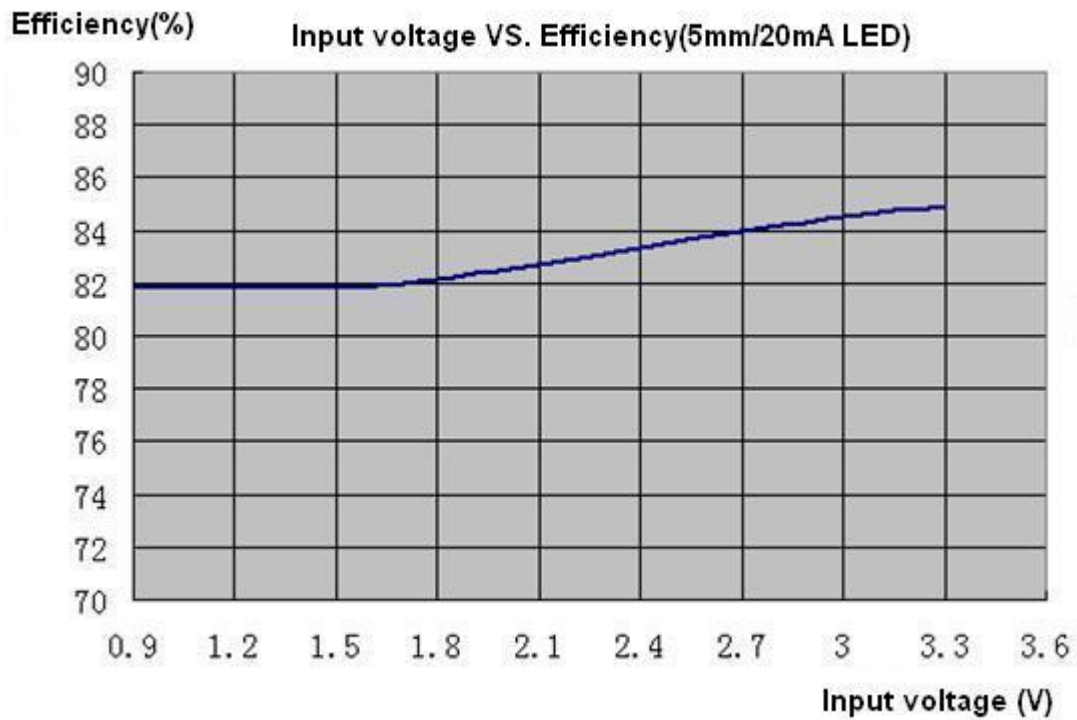


(9) Test CE low voltage

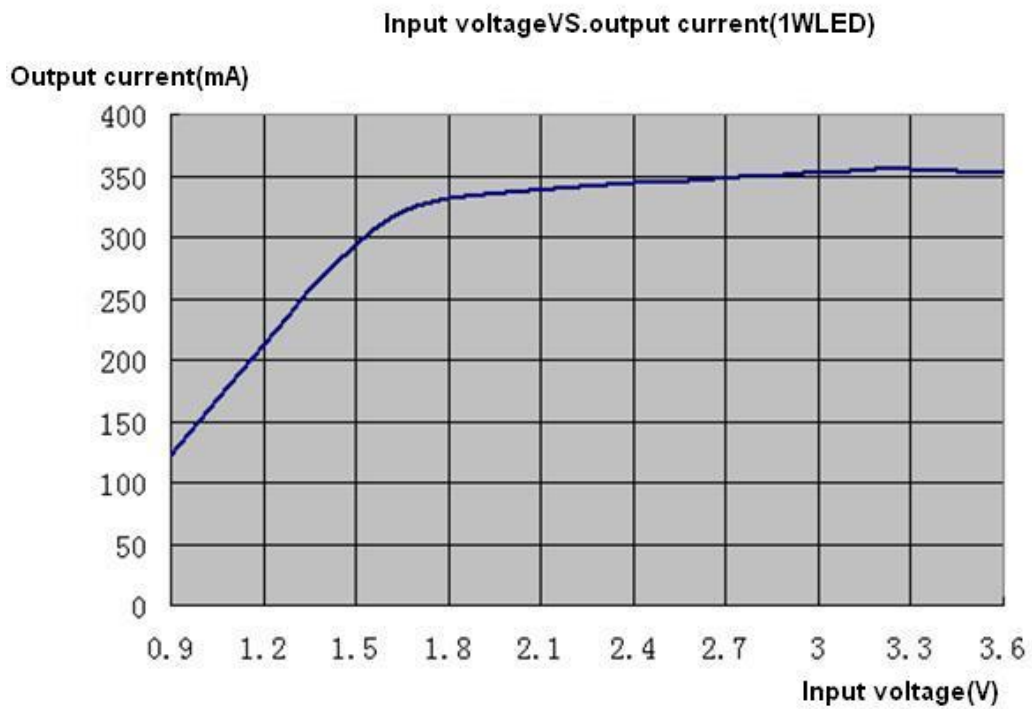
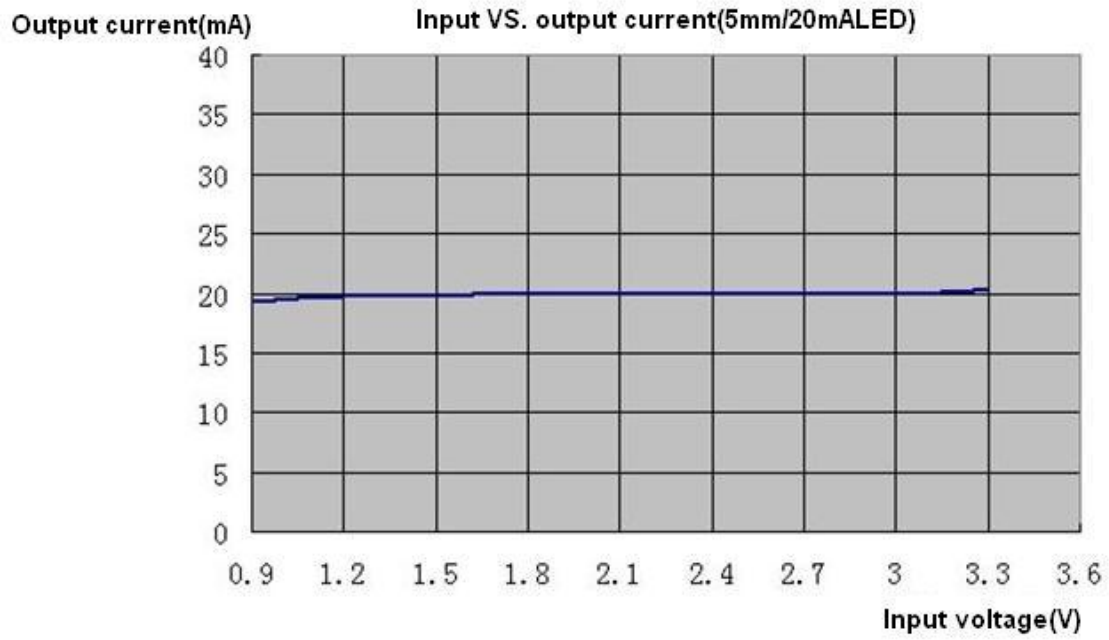


Operating Characteristics:

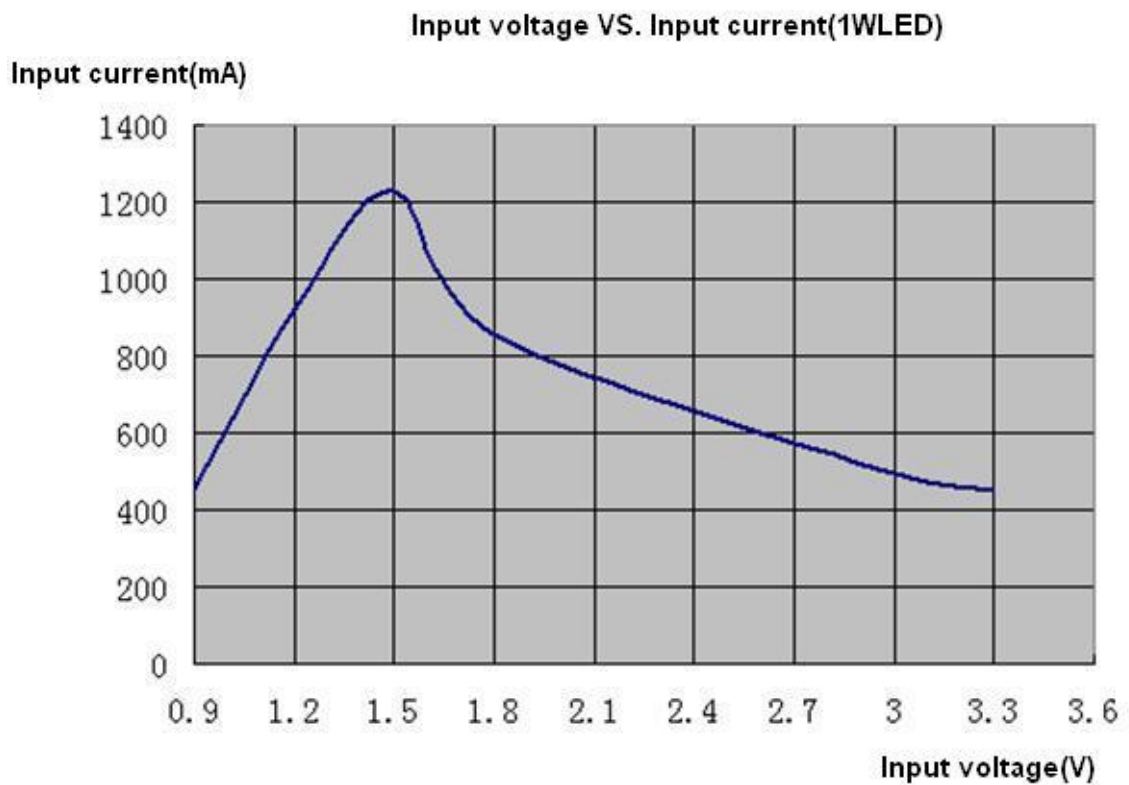
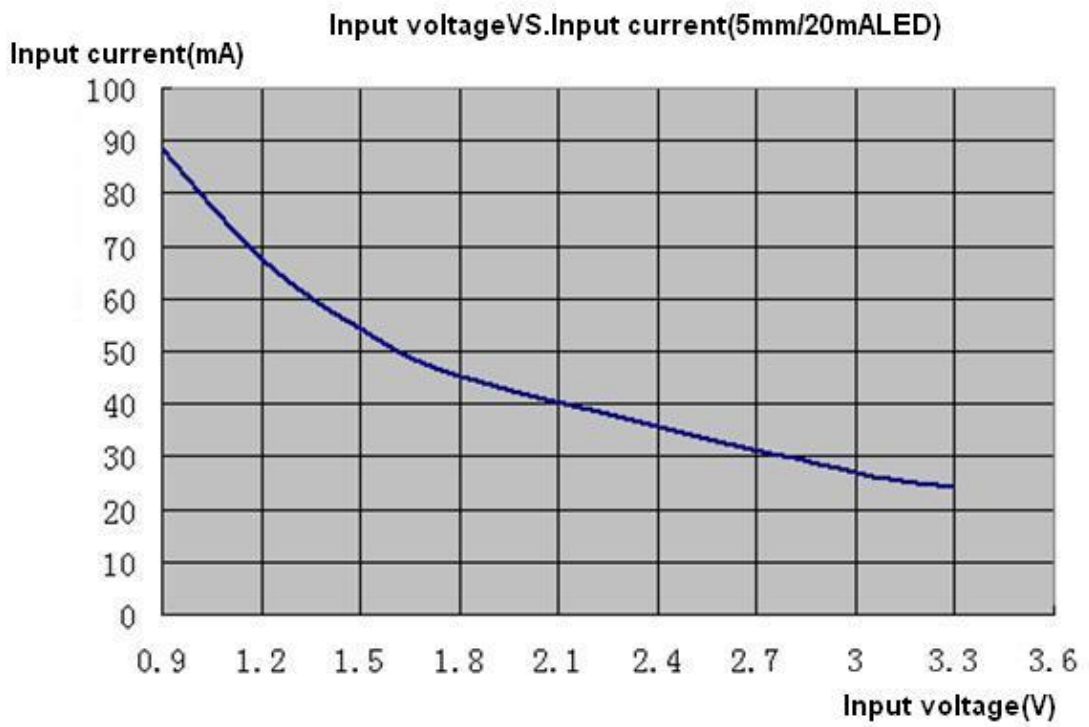
(1) Input Voltage VS. Efficiency



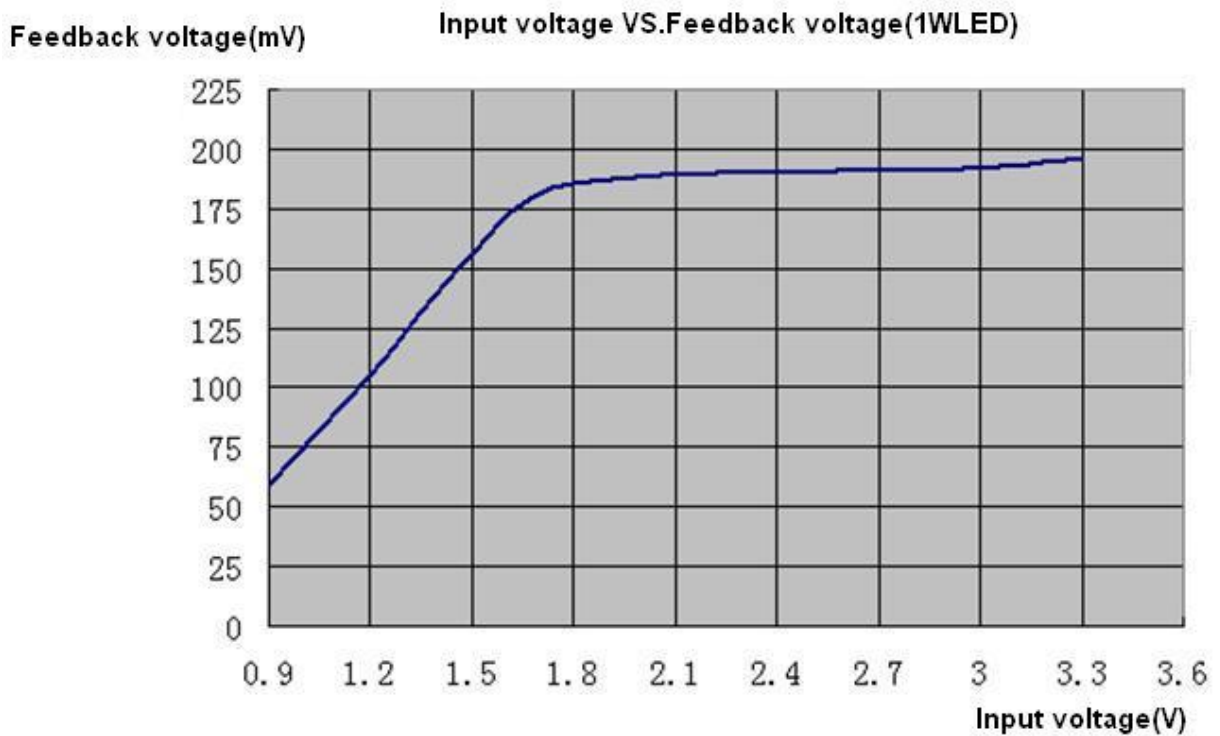
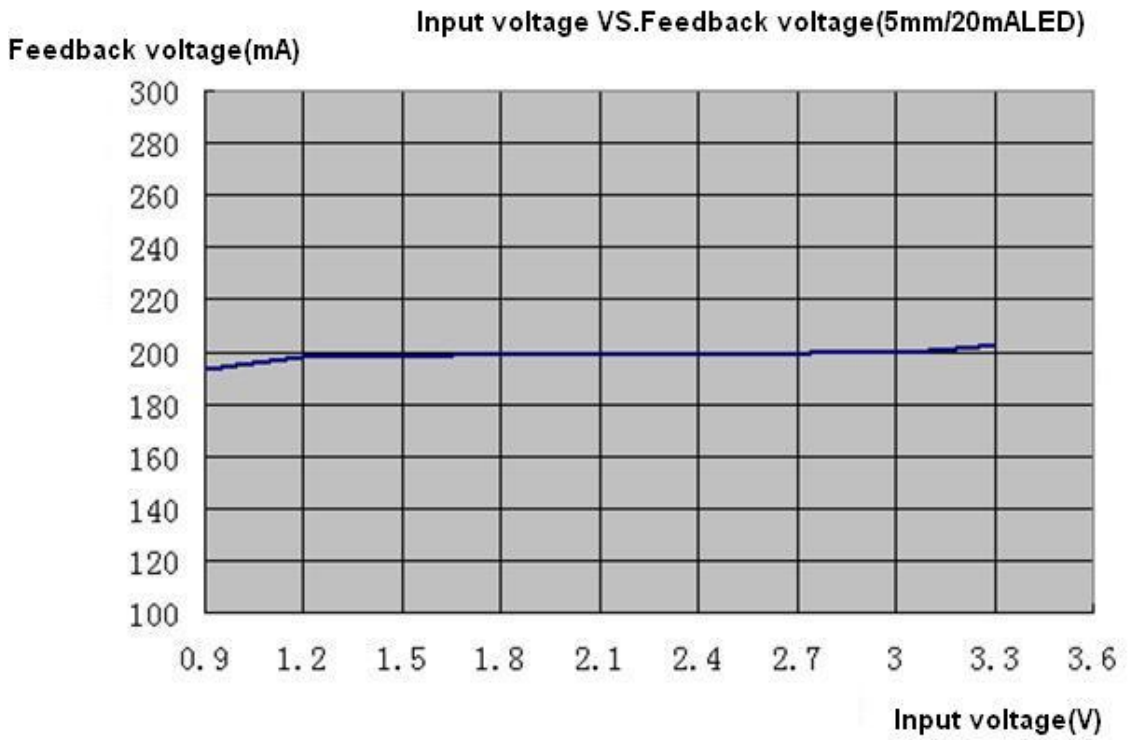
(2) Input voltage VS. output current



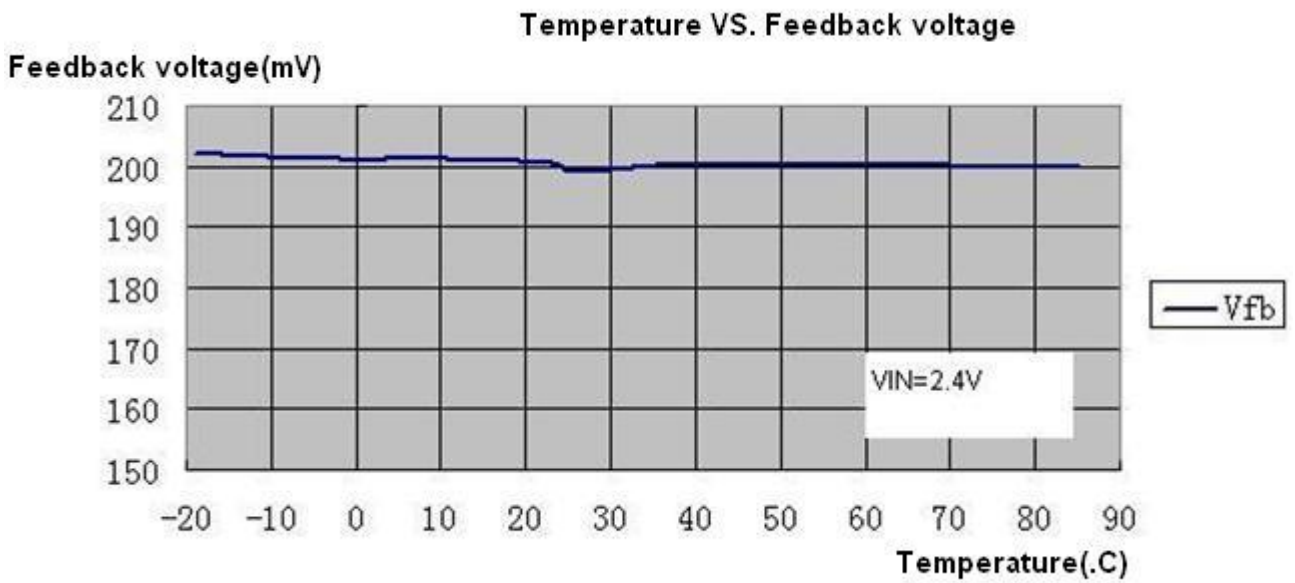
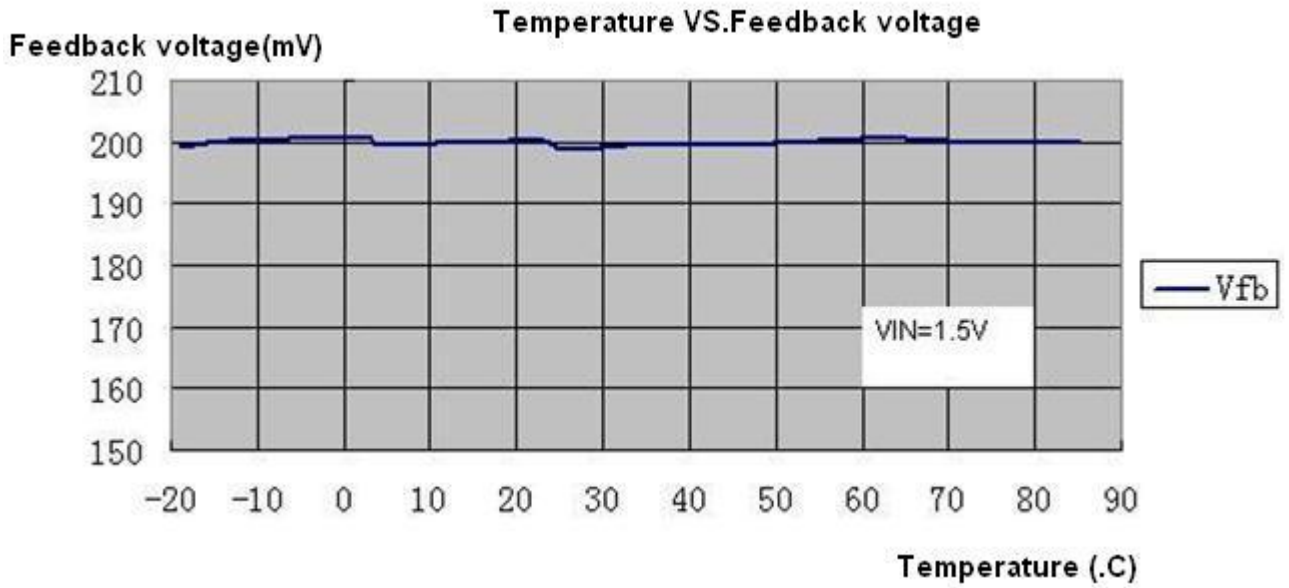
(3) Input voltage VS. Input current



(4) Input voltage VS.Feedback voltage

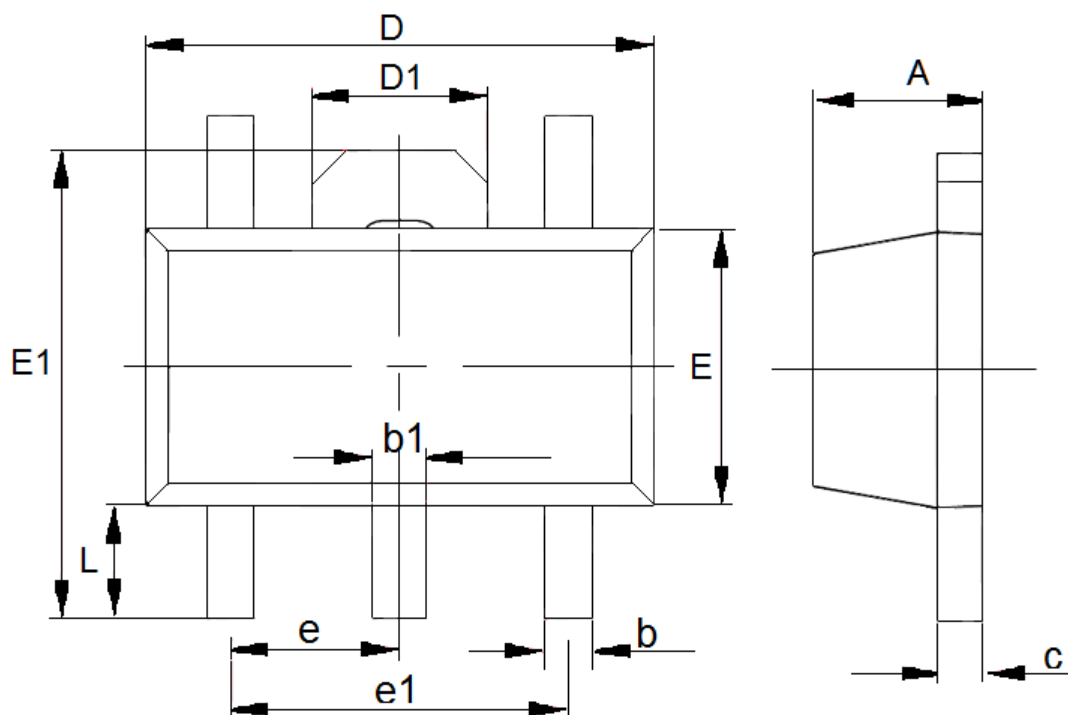


(5) Temperature VS. Feedback Voltage(tow Parallel 5mm/20mA LED)



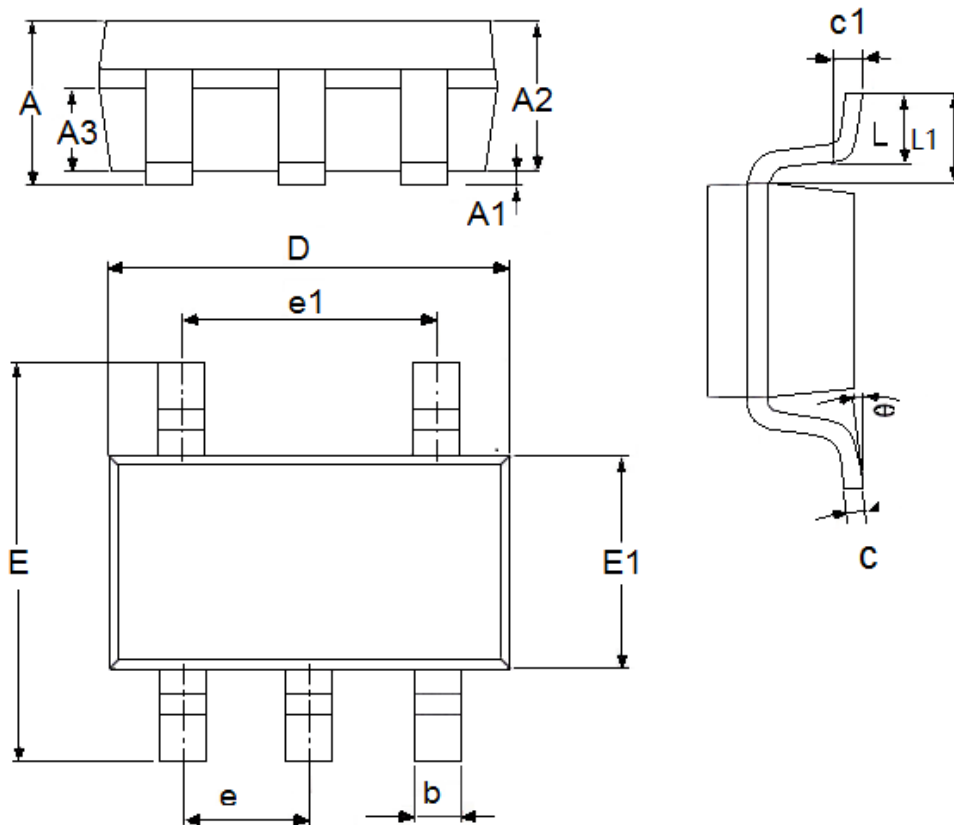
Package Information

- Packaging Type: SOT89-5



| 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 | 0.38 | 0.58 | 0.0150 | 0.0228 |
| c | 0.35 | 0.47 | 0.0138 | 0.0185 |
| D | 4.4 | 4.6 | 0.1732 | 0.1811 |
| D1 | 1.55(TYP) | | 0.061(TYP) | |
| e1 | 3(TYP) | | 0.1181(TYP) | |
| E | 2.3 | 2.6 | 0.0906 | 0.1023 |
| E1 | 3.94 | 4.4 | 0.1551 | 0.1732 |
| e | 1.5(TYP) | | 0.0591(TYP) | |
| L | 0.8 | 1.2 | 0.0315 | 0.0472 |

● Packaging Type: SOT23-5



| DIM | Millimeters | | Inches | |
|----------|-------------|------|-------------|--------|
| | Min | Max | Min | Max |
| A | 1.05 | 1.45 | 0.0413 | 0.0571 |
| A1 | 0 | 0.15 | 0.0000 | 0.0059 |
| A2 | 0.9 | 1.3 | 0.0354 | 0.0512 |
| A3 | 0.6 | 0.7 | 0.0236 | 0.0276 |
| b | 0.25 | 0.5 | 0.0098 | 0.0197 |
| c | 0.1 | 0.23 | 0.0039 | 0.0091 |
| D | 2.82 | 3.05 | 0.1110 | 0.1201 |
| e1 | 1.9(TYP) | | 0.0748(TYP) | |
| E | 2.6 | 3.05 | 0.1024 | 0.1201 |
| E1 | 1.5 | 1.75 | 0.0512 | 0.0689 |
| e | 0.95(TYP) | | 0.0374(TYP) | |
| L | 0.25 | 0.6 | 0.0098 | 0.0236 |
| L1 | 0.59(TYP) | | 0.0232(TYP) | |
| θ | 0 | 8° | 0.0000 | 8° |
| c1 | 0.2(TYP) | | 0.0079(TYP) | |

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