**SMALL PACKAGE PFM CONTROL**
**STEP-UP DC/DC CONVERTER**

# CE8301 Series

## ■ Introduction

**The CE8301 Series** is a CMOS PFM-control step-up switching DC/DC converter that mainly consists of a reference voltage source, an oscillator, and a comparator. The PFM controller allows the duty ratio to be automatically switched according to the load (light load: 50%, high output current: 75%), enabling products with a low ripple over a wide range, high efficiency, and high output current. With the CE8301 Series, a step-up switching DC/DC converter can be configured by using an external coil, capacitor, and diode. The built-in MOS FET is turned off by a protection circuit when the voltage at the LX pin exceeds the limit to prevent it from being damaged. This feature, along with the mini package and low current consumption, makes the CE8301 Series ideal for applications such as the power supply unit of portable equipment.

## ■ Applications

- Power supply for portable equipment such as digital cameras, electronic notebooks, and PDAs
- Power supply for audio equipment such as portable CD/MD players
- Constant voltage power supply for cameras, video equipment, and communications equipment
- Power supply for microcomputers

## ■ Features

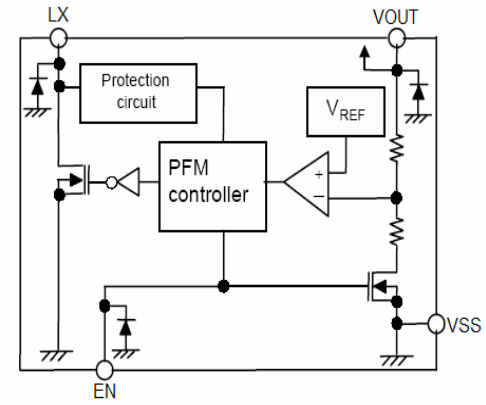
- Low voltage operation: Startup at 0.9 V min. ($I_{OUT}$ = 1 mA) guaranteed
- Duty ratio: 66/78%, builtin auto switching type PFM controller
- External parts: Coil, capacitor, diode
- Output voltage: Settable to between 1.8 to 6.5 V in 0.1 V steps
- Accuracy of ±2%
- High efficiency：85%（typ.）
- Standard function (product type A)
- Shutdown function (product type C、D)
- Output voltage Adjustable type (product type E、F)
- External transistor type available (product type B、 E、F)

## ■ Ordering Information

CE8301 X XX X

- Package :
  - P-SOT89
  - M-SOT23
  - T-TO92
- Output voltage:
  - 18：1.8V
  - :
  - 50：5.0V
- Series :
  - A：Standard LX
  - B：Standard EXT
  - C：With shutdown, LX
  - D：Withshutdown, EXT
  - E：Output voltage Adjustable,LX
  - F：Output voltage Adjustable,EXT

## ■ Block Diagrams




## Pin Assignment

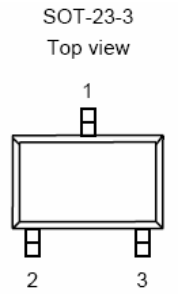



Table 1 CE8301A Series（SOT-23-3 PKG）

| Pin No. | Pin Name | Functions |
|---|---|---|
| 1 | $V_{OUT}$ | Output voltage pin |
| 2 | $V_{SS}$ | GND pin |
| 3 | LX | External inductor connection pin |

Table 2 CE8301B Series（SOT-23-3 PKG）

| Pin No. | Pin Name | Functions |
|---|---|---|
| 1 | $V_{OUT}$ | Output voltage pin |
| 2 | $V_{SS}$ | GND pin |
| 3 | EXT | External transistor connection pin |

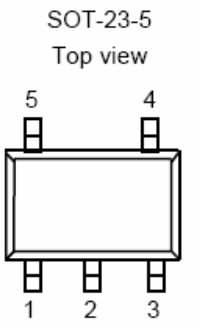



Table 3 CE8301C Series（SOT-23-5 PKG）

| Pin No. | Pin Name | Functions |
|---|---|---|
| 1 | EN | Shutdown pin<br>“H”: Normal operation<br>“L”: Step-up stopped |
| 2 | $V_{OUT}$ | Output voltage pin |
| 3 | NC | (N.C.) |
| 4 | $V_{SS}$ | GND pin |
| 5 | LX | External transistor connection pin |

Table 4 CE8301D Series（SOT-23-5 PKG）

| Pin No. | Pin Name | Functions |
|---|---|---|
| 1 | EN | Shutdown pin<br>“H”: Normal operation<br>“L”: Step-up stopped |
| 2 | $V_{OUT}$ | Output voltage pin |
| 3 | NC | (N.C.) |
| 4 | $V_{SS}$ | GND pin |
| 5 | EXT | External transistor connection pin |

Table 5 CE8301 ESeries（SOT-23-5 PKG）

| Pin No. | Pin Name | Functions |
|---|---|---|
| 1 | VOUT (FB) | Output voltage fixed output type; Output voltage monitoring pin (Output voltage external setting type; Feedback pin) |
| 2 | $V_{DD}$ | IC power supply pin |
| 3 | NC | (N.C.) |
| 4 | $V_{SS}$ | GND pin |
| 5 | LX | External transistor connection pin |

Table 6 CE8301 FSeries（SOT-23-5 PKG）

| Pin No. | Pin Name | Functions |
|---|---|---|
| 1 | VOUT (FB) | Output voltage fixed output type; Output voltage monitoring pin (Output voltage external setting type; Feedback pin) |
| 2 | $V_{DD}$ | IC power supply pin |
| 3 | NC | (N.C.) |
| 4 | $V_{SS}$ | GND pin |
| 5 | EXT | External transistor connection pin |

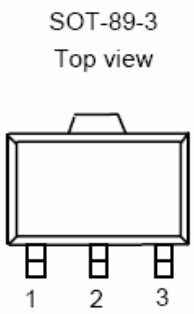



Table 7 CE8301A Series （SOT-89-3 PKG）

| Pin No. | Pin Name | Functions |
|---|---|---|
| 1 | $V_{SS}$ | GND pin |
| 2 | $V_{OUT}$ | Output voltage pin |
| 3 | LX | External inductor connection pin |

Table 8 CE8301B Series （SOT-89-3 PKG）

| Pin No. | Pin Name | Functions |
|---|---|---|
| 1 | $V_{SS}$ | GND pin |
| 2 | $V_{OUT}$ | Output voltage pin |
| 3 | EXT | External transistor connection pin |

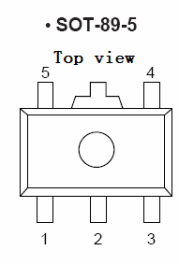



Table 9 CE8301E Series （SOT-89-5 PKG）

| Pin No. | Pin Name | Functions |
|---|---|---|
| 1 | NC | (N.C.) |
| 2 | $V_{DD}$ | IC power supply pin |
| 3 | VOUT (FB) | Output voltage fixed output type; Output voltage monitoring pin (Output voltage external setting type; Feedback pin) |
| 4 | LX | External transistor connection pin |
| 5 | $V_{SS}$ | GND pin |

Table 10 CE8301F Series（SOT-89-5 PKG）

| Pin No. | Pin Name | Functions |
|---|---|---|
| 1 | NC | (N.C.) |
| 2 | $V_{DD}$ | IC power supply pin |
| 3 | VOUT (FB) | Output voltage fixed output type; Output voltage monitoring pin (Output voltage external setting type; Feedback pin) |
| 4 | EXT | External transistor connection pin |
| 5 | $V_{SS}$ | GND pin |

## ■ Absolute Maximum Ratings

(Unless otherwise specified, Ta=25 C)

| Parameter | | Symbol | Ratings | Unit |
|---|---|---|---|---|
| VOUT pin voltage | | $V_{OUT}$ | $V_{SS}$－0.3 ~ $V_{SS}$＋10 | V |
| EN pin voltage | | EN | $V_{SS}$－0.3 ~ $V_{SS}$＋10 | V |
| LX pin voltage | | $V_{LX}$ | $V_{SS}$－0.3 ~ $V_{SS}$＋10 | V |
| LX pin current | | $I_{LX}$ | 1000 | mA |
| Power dissipation | SOT-23-3 | PD | 250 | mW |
| | SOT-23-5 | | 250 | mW |
| | SOT-89-3 | | 500 | mW |
| Operating temperature | | Topr | －40 ~＋85 | °C |
| Storage temperature | | Tstg | －40 ~＋125 | °C |

## ■ Electrical Characteristics

(Unless otherwise specified, Ta =25 C)

| Parameter | Symbol | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Output voltage | $V_{OUT}$ | － | | $V_{OUT(S)}$ ×0.98 | $V_{OUT}$ | $V_{OUT(S)}$ ×1.02 | V |
| Input voltage | $V_{IN}$ | － | | － | － | 10 | V |
| Operation start voltage | $V_{ST1}$ | $I_{OUT}$= 1 mA | | － | － | 0.9 | V |
| Oscillation start voltage | $V_{ST2}$ | No external parts, voltage applied to $V_{OUT}$ LX pulled up to $V_{OUT}$ via 300Ω resistor | | － | － | 0.8 | V |
| Current consumption 1 | $I_{SS1}$ | $V_{OUT}$=0.95 ×$V_{OUT}$ | $V_{OUT}$: 3.0V | － | 30 | 40 | μA |
| | | | $V_{OUT}$: 5.0V | | 50 | 60 | μA |
| Current consumption 2 | $I_{SS2}$ | $V_{OUT}$=$V_{OUT}$＋0.5 V | | － | 6 | 10 | μA |
| Current consumption during shutdown | $I_{SSS}$ | $V_{EN}$ = 0 V | | － | － | 0.5 | μA |
| Switching current | $I_{SW}$ | $V_{LX}$= 0.4 V | | 100 | 200 | － | mA |
| Switching transistor leakage current | $I_{SWQ}$ | No external parts, $V_{LX}$=$V_{OUT}$ =10 V ,$V_{EN}$ = 0 V | | － | － | 0.5 | μA |
| Line regulation | $\Delta V_{OUT1}$ | $V_{IN}$= 0.4×$V_{OUT}$～ 0.6×$V_{OUT}$ | | － | 20 | 50 | mV |

| | | | | | | |
|---|---|---|---|---|---|---|
| Load regulation | $\Delta V_{OUT2}$ | $I_{OUT}$= 10 μA ~ 50mA | — | 20 | 50 | mV |
| Maximum Oscillation frequency | $f_{OSC}$ | $V_{OUT}$= 0.95×$V_{OUT}$, measure waveform at LX pin | | 100 | | kHz |
| Duty ratio 1 | Duty1 | $V_{OUT}$= 0.95×$V_{OUT}$, measure waveform at LX pin | 70 | 78 | 85 | % |
| Duty ratio 2 | Duty2 | Measure waveform at LX pin with light load | — | 66 | — | % |
| Efficiency | EFFI | | | 85 | | % |
| Shutdown pin input voltage | $V_{SH}$ | $V_{OUT}$=0.95×$V_{OUT}$, judge oscillation at LX pin | 0.75 | — | — | V |
| | $V_{SL1}$ | $V_{OUT}$= 0.95×$V_{OUT}$, judge stop at LX pin | — | — | 0.3 | V |
| Shutdown pin input current | $I_{SH}$ | $V_{EN}$=10V | −0.1 | — | 0.1 | μA |
| | $I_{SL}$ | $V_{EN}$=0V | −0.1 | — | 0.1 | μA |

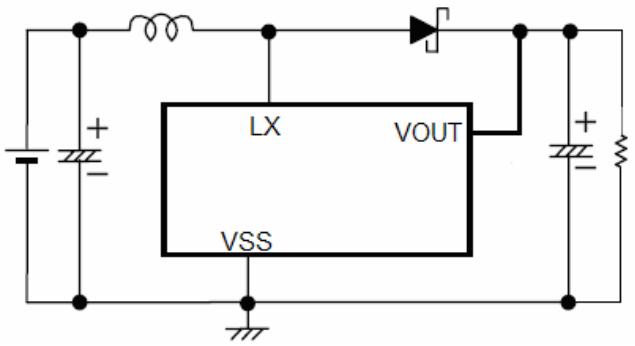
Remark: $V_{IN}$ =$V_{OUT(S)}$ ×0.6 applied, $I_{OUT}$=$V_{OUT(S)}$ / 250 Ω

Shutdown function built-in type: EN pin is connected to $V_{OUT}$

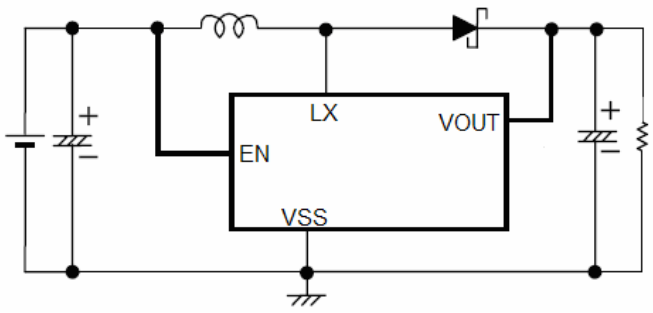
$V_{OUT(S)}$ specified above is the set output voltage value, and $V_{OUT}$ is the typical value of the actual output voltage.

## ■ Standard Circuits

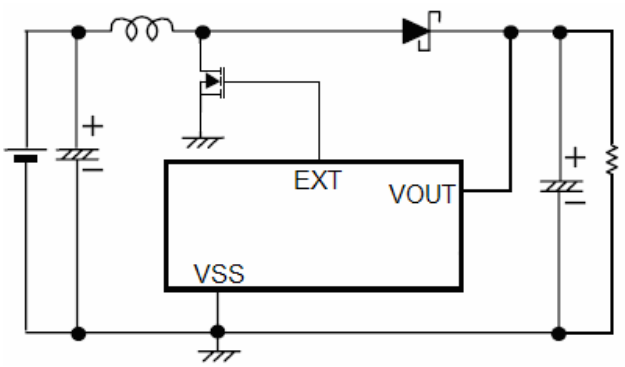
### 1、CE8301A Circuits:



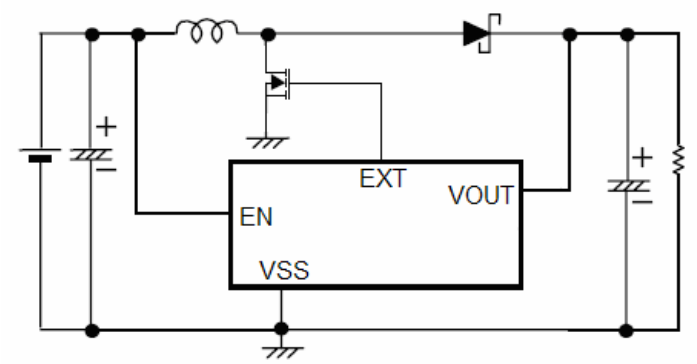

### 2、CE8301C Circuits:



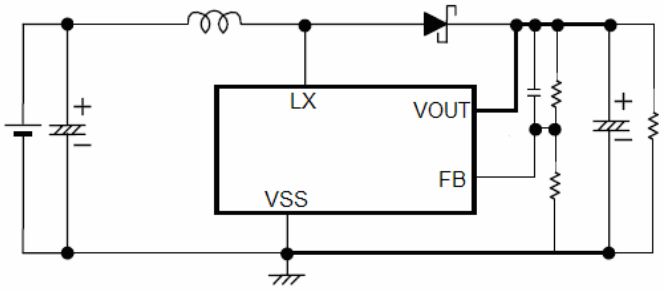
**3、CE8301B Circuits：**



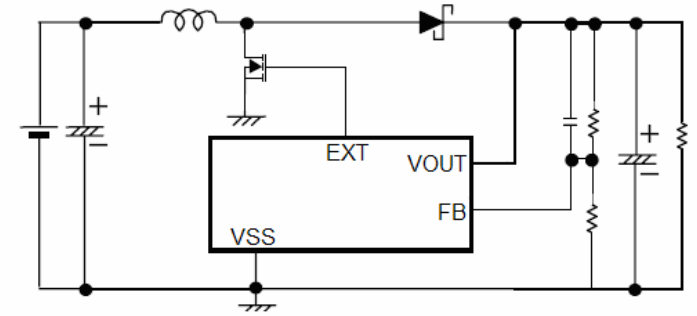

**4、CE8301D Circuits：**




**5、CE8301E Circuits：**



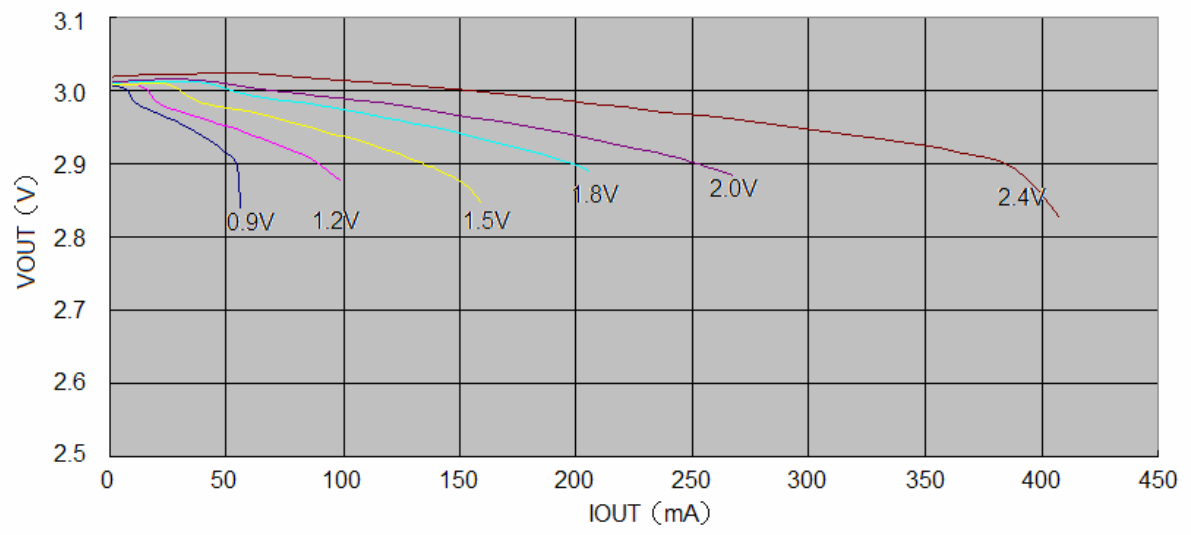

**6、CE8301F Circuits:**



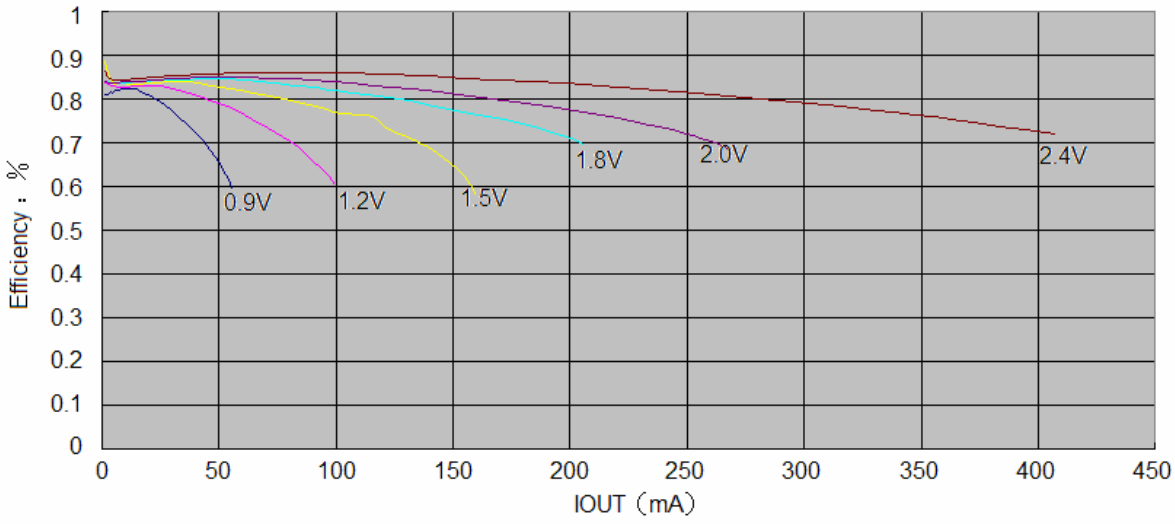
## ■ Characteristics

### 1. CE8301A30P：

**a、$V_{OUT}$ vs. $I_{OUT}$ :**

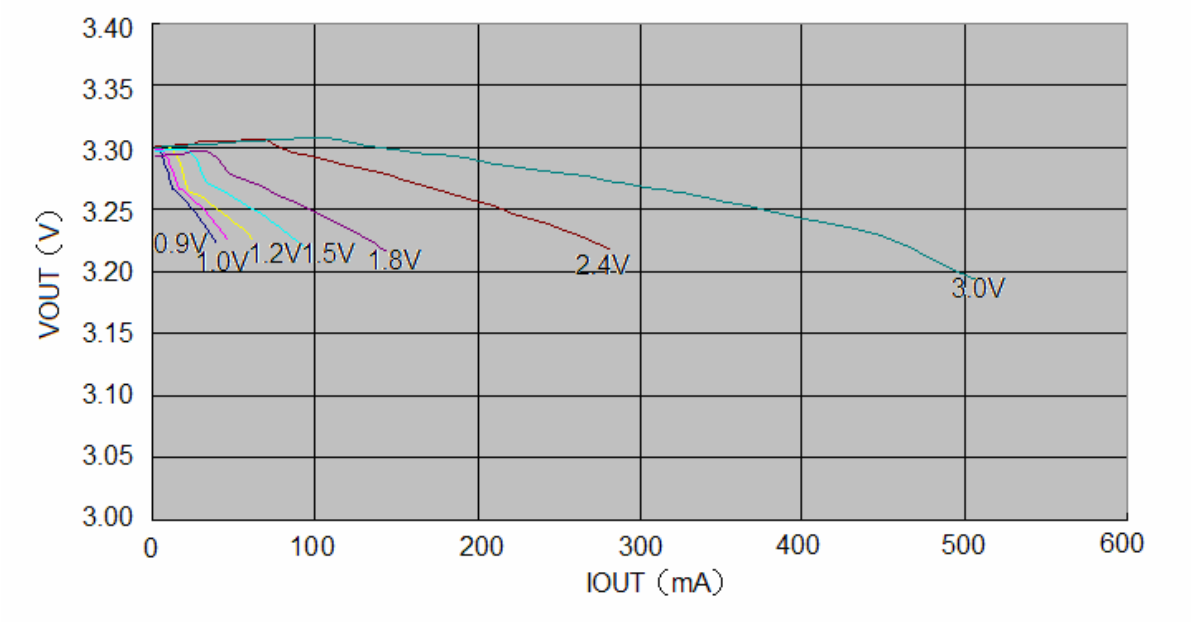



**b. Efficiency vs. $I_{OUT}$ :**

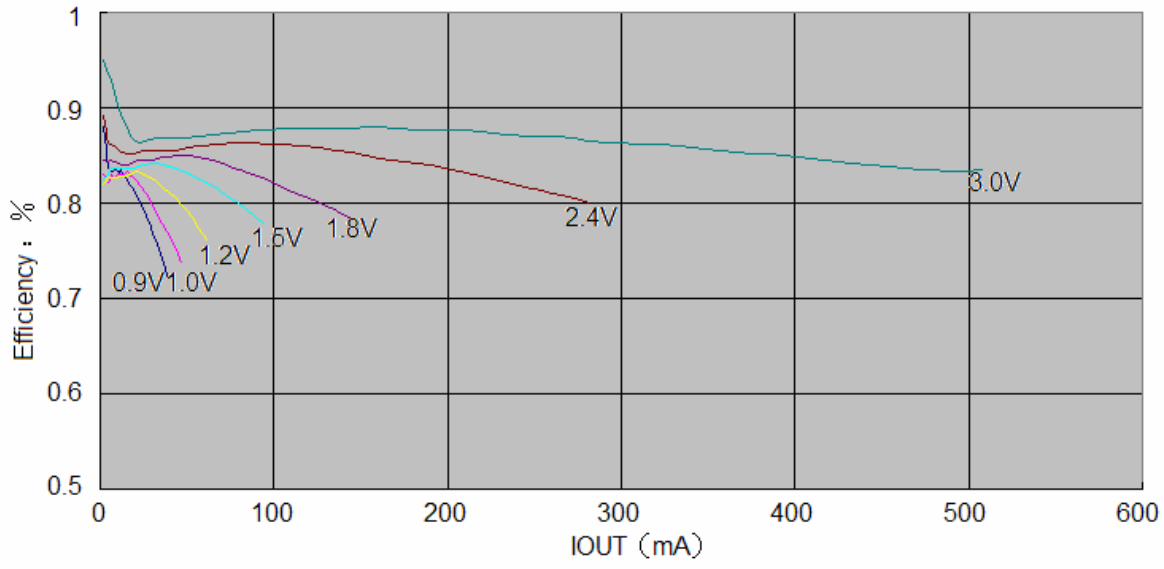


## 2. CE8301A33P：

**a、$V_{OUT}$ vs. $I_{OUT}$ :**

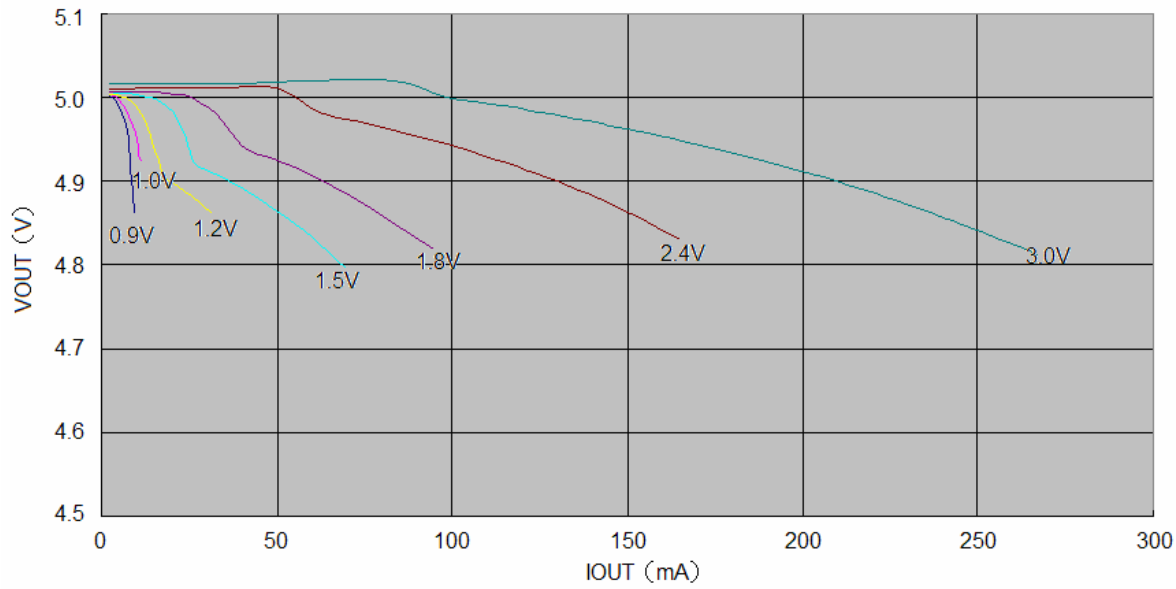



**b、Efficiency vs. $I_{OUT}$ :**

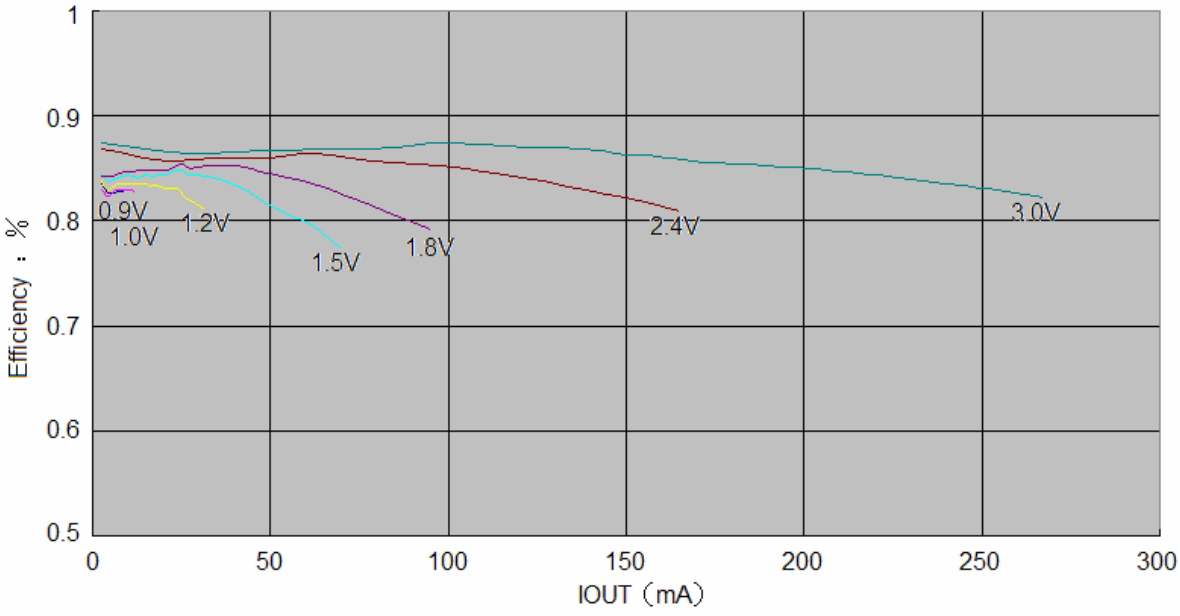


### 3. CE8301A50P：

**a. $V_{OUT}$ vs. $I_{OUT}$ :**

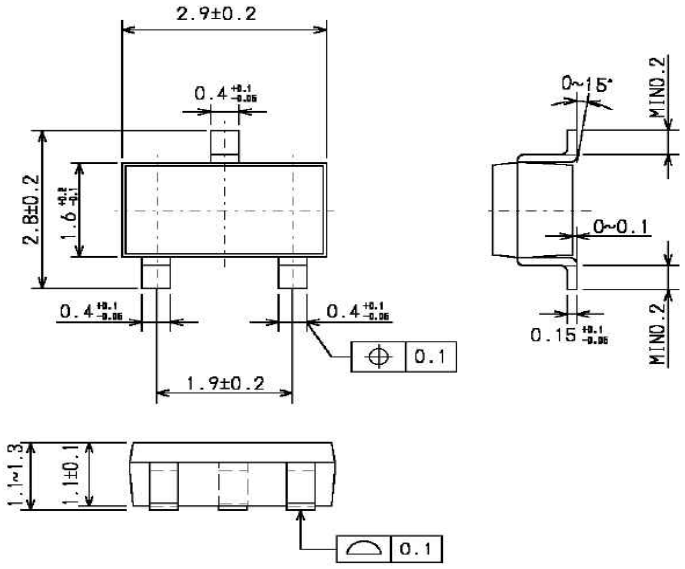



**b. Efficiency vs. $I_{OUT}$ :**

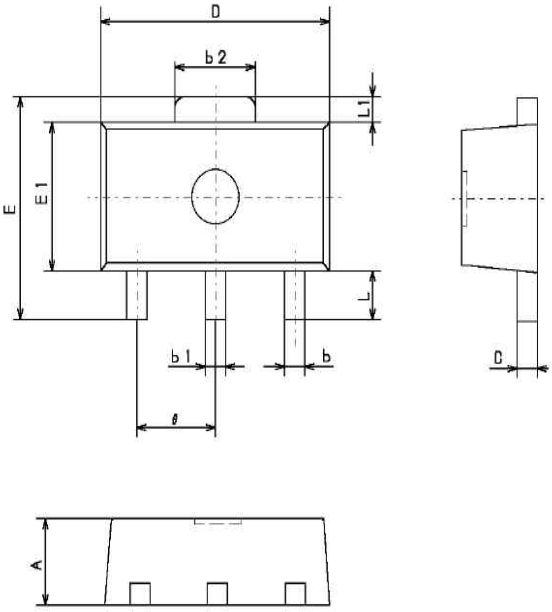


## ■ Package information

● SOT-23

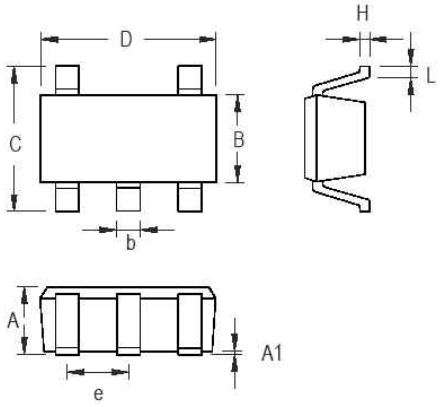



● SOT-89



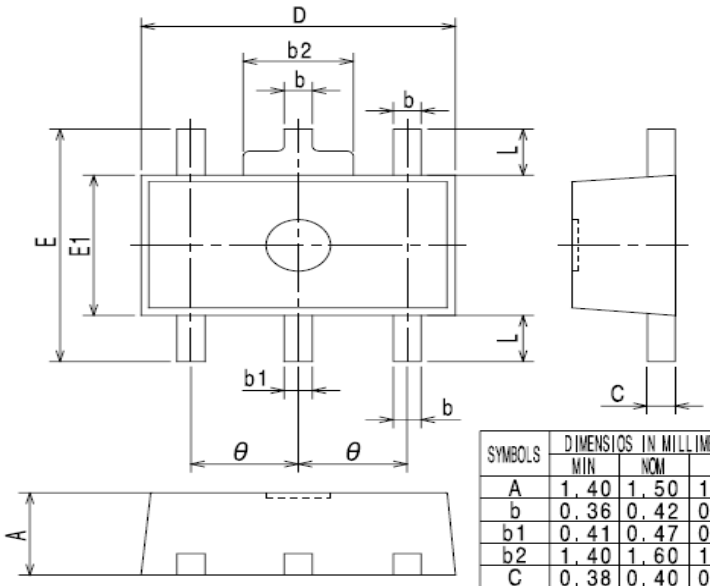

| Symbols | Dimensions in millimeters | | |
|---|---|---|---|
| | Min | Nom | Max |
| A | 1.40 | 1.50 | 1.60 |
| b | 0.36 | 0.42 | 0.48 |
| b1 | 0.41 | 0.47 | 0.53 |
| b2 | 1.40 | 1.60 | 1.75 |
| C | 0.38 | 0.40 | 0.43 |
| D | 4.40 | 4.50 | 4.60 |
| E | — | — | 4.25 |
| E1 | 2.40 | 2.50 | 2.60 |
| θ | 1.40 | 1.50 | 1.60 |
| L | 1.80 | — | — |
| L1 | — | 0.40 | — |

● **SOT- 23- 5**




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.889 | 1.295 | 0.035 | 0.051 |
| A1 | 0.000 | 0.152 | 0.000 | 0.006 |
| B | 1.397 | 1.803 | 0.055 | 0.071 |
| b | 0.356 | 0.559 | 0.014 | 0.022 |
| C | 2.591 | 2.997 | 0.102 | 0.118 |
| D | 2.692 | 3.099 | 0.106 | 0.122 |
| e | 0.838 | 1.041 | 0.033 | 0.041 |
| H | 0.080 | 0.254 | 0.003 | 0.010 |
| L | 0.300 | 0.610 | 0.012 | 0.024 |

● **SOT- 89- 5**




| SYMBOLS | DIMENSIOS IN MILLIMETERS | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 1.40 | 1.50 | 1.60 |
| b | 0.36 | 0.42 | 0.48 |
| b1 | 0.41 | 0.47 | 0.53 |
| b2 | 1.40 | 1.60 | 1.75 |
| C | 0.38 | 0.40 | 0.43 |
| D | 4.40 | 4.50 | 4.60 |
| E | — | — | 4.25 |
| E1 | 2.40 | 2.50 | 2.60 |
| e | 1.40 | 1.50 | 1.60 |
| L | 0.80 | — | — |