上海贝岭 SHANGHAI BELLING

# BL8506

***High-precision Low Voltage Detector***

## Outline:

BL8506 is a series of high precision voltage detector with ultra low current consumption (500nA typ. at Vdd=3.0V). It can work at very low voltage, which makes it perfect for system reset.

BL8506 is composed of high precision voltage reference, comparator, output driver and resistor array. Internally preset detect voltage has a low temperature drift and requires no external trimming.

Two type of output, CMOS and N-channel open-drain are available.

BL8506 is available in SOT-89-3,SOT-23-3 TO92, SOT23-5 packages which is Pb free.

## Features：

- High-precision detection Voltage： ±2%
- Detection Voltage：0.9V~6.0V (in 0.1V steps)
- Precise hysteresis：4% typ.
- Operating Voltage range：0.7V~10V
- Ultra-low current consumption：500nA typ. (at $V_{DD}$＝3.0V)
- Two Output forms ： CMOS and N-channel open-drain

## Application：

- Power monitor for portable equipment such as PDA,DSC,Mobile phone,Notebook,MP3
- CPU and Logic Circuit Reset
- Battery Checker
- Battery Back-up Circuit
- Power Failure Detector

## Selection Guide：

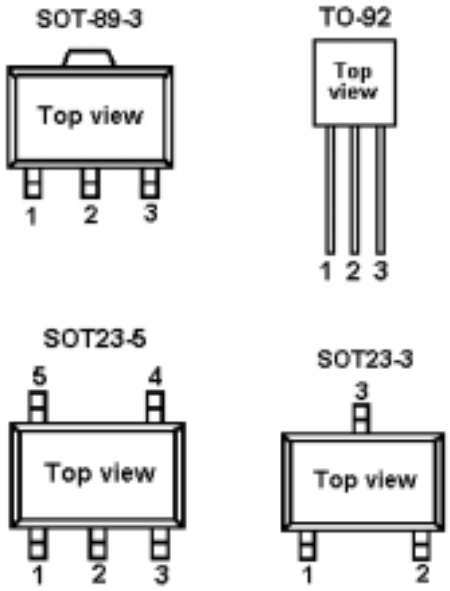
**BL8506-*XX X XX***

Package Type：
RM： SOT-23-3
RN： SOT-23-5
SM： SOT-89-3
T： TO-92
（Default、Pb Free）

Output Type：
N：Nch Open-drain
C：CMOS

Detector Voltage：
09 0.9V
30 3.0V
50 5.0V
60 6.0V

## Pin Assignment：



## Pin Description:

| PIN Number | | | | PIN Name | Function |
|---|---|---|---|---|---|
| SOT-89-3 | TO-92 | SOT-23-3 | SOT-23-5 | | |
| 1 | 3 | 1 | 1 | VOUT | Voltage detection output Pin |
| 2 | 1 | 3 | 2 | VDD | Voltage input Pin |
| 3 | 2 | 2 | 3 | VSS | GND Pin |
| — | — | — | 4 | NC | No connection |
| — | — | — | 5 | NC | No connection |

## Product Classification:

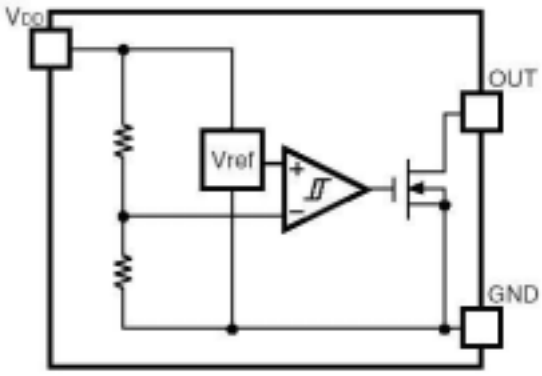
| Product Name | Detector Voltage | Output Type | Package |
|---|---|---|---|
| BL8506-XXNRM | XX V | Nch Open-Drain | SOT-23-3 |
| BL8506-XXNRN | XX V | Nch Open-Drain | SOT-23-5 |
| BL8506-XXNSM | XX V | Nch Open-Drain | SOT-89-3 |
| BL8506-XXNT | XX V | Nch Open-Drain | TO-92 |
| BL8506-XXCRM | XX V | CMOS | SOT-23-3 |
| BL8506-XXCRN | XX V | CMOS | SOT-23-5 |
| BL8506-XXCSM | XX V | CMOS | SOT-89-3 |
| BL8506-XXCT | XX V | CMOS | TO-92 |

## Product Mark Information:

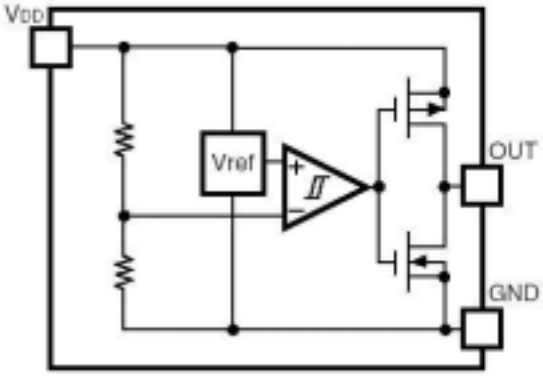
| Product NO. | Mark |
|---|---|
| BL8506-09CSM | BL8506-09C |
| BL8506-20CT | BL8506-20C |
| BL8506-27CSM | BL8506-27C |
| BL8506-30CT | BL8506-30C |
| | |
| BL8506-09NRM | N609 |
| BL8506-21NRN | N621 |
| BL8506-27CRM | C627 |
| BL8506-30CRM | C630 |
| | |

| SOT-89-3<br>TO-92 | SOT-23-5<br>SOT-23-3 |
|---|---|
| Example：<br>BL8506-30NSM<br>BL8506<br>N30XX | Example：<br>BL8506-30CRM<br>C630 |

## Block diagram:




N channel open-drain




CMOS output

### Absolute Maximum Ratings：

Input Voltage range ---------- -0.3V~12V
Output Voltage range ---------- -0.3V~12V
Maximum Output current---------- 70mA
Maximum power dissipation---------- 150mW
Ambient temperature---------- -40~+70°C
Storage temperature ---------- -40~125°C
Lead temperature and time---------- 260°C,10S

### Recommended Work Conditions：

| Item | Min | Recommended | Max | unit |
|---|---|---|---|---|
| Input Voltage range | 0.7 | | 10 | V |
| Ambient temperature | -40 | 25 | 70 | ℃ |

### Electrical Characteristics：

- BL8506-09C/NXX（0.9V）　　(Topt＝25℃,Unless otherwise specified.)

| Symbol | Parameter | Conditions | Reference data | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| -VDET | Detector Threshold | | 0.882 | 0.9 | 0.918 | V |
| VHYS | Detector Threshold Hysteresis | | 0.018 | 0.036 | 0.054 | V |
| ISS | Current consumption | VDD=2.9V | | 1 | 1.5 | uA |
| VDDH | Maximum operating voltage | | | | 10 | V |
| VDDL | Minimum Operating voltage | | | 0.5 | | V |
| IOUT | Output current | Nch<br>VDS=0.05V，VDD=0.7V<br>VDS=0.50V，VDD=0.8V | <br>0.01<br>0.05 | <br>0.05<br>0.50 | | mA |
| | | Pch<br>VDS=-2.1V，VDD=4.50V | 1.0 | 2.0 | | mA |
| TPLH | Output Delay Time | | | | 20 | uS |

- BL8506-27C/NXX（2.7V） (Topt＝25℃,Unless otherwise specified.)

| Symbol | Parameter | Conditions | Reference data | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| -$V_{DET}$ | Detector Threshold | | 2.646 | 2.7 | 2.754 | V |
| $V_{HYS}$ | Detector Threshold Hysteresis | | 0.054 | 0.108 | 0.162 | V |
| $I_{SS}$ | Current consumption | $V_{DD}$=4.7V | | 0.5 | 1 | uA |
| $V_{DDH}$ | Maximum operating voltage | | | | 10 | V |
| $V_{DDL}$ | Minimum Operating voltage | | | 0.5 | | V |
| $I_{OUT}$ | Output current | Nch $V_{DS}$=0.05V, $V_{DD}$=0.70V | 0.01 | 0.05 | | mA |
| | | Pch $V_{DS}$=-2.1V, $V_{DD}$=4.50V | 1.0 | 2.0 | | mA |
| $T_{PLH}$ | Output Delay Time | | | | 20 | uS |

- BL8506-30C/NXX（3.0V） (Topt＝25℃,Unless otherwise specified.)

| Symbol | Parameter | Conditions | Reference data | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| -$V_{DET}$ | Detector Threshold | | 2.94 | 3.0 | 3.06 | V |
| $V_{HYS}$ | Detector Threshold Hysteresis | | 0.060 | 0.12 | 0.18 | V |
| $I_{SS}$ | Current consumption | $V_{DD}$=5.0V | | 0.5 | 1 | uA |
| $V_{DDH}$ | Maximum operating voltage | | | | 10 | V |
| $V_{DDL}$ | Minimum Operating voltage | | | 0.5 | | V |
| $I_{OUT}$ | Output current | Nch $V_{DS}$=0.05V，$V_{DD}$=0.7V | 0.01 | 0.05 | | mA |
| | | Pch $V_{DS}$=-2.1V，$V_{DD}$=4.50V | 1.0 | 2.0 | | mA |
| $T_{PLH}$ | Output Delay Time | | | | 20 | uS |

- BL8506-34C/NXX（3.4V） (Topt＝25℃,Unless otherwise specified.)

| Symbol | Parameter | Conditions | Reference data | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| -$V_{DET}$ | Detector Threshold | | 3.332 | 3.4 | 3.468 | V |
| $V_{HYS}$ | Detector Threshold Hysteresis | | 0.068 | 0.136 | 0.204 | V |
| $I_{SS}$ | Current consumption | $V_{DD}$=5.0V | | 0.5 | 1 | uA |
| $V_{DDH}$ | Maximum operating voltage | | | | 10 | V |
| $V_{DDL}$ | Minimum Operating | | | 0.5 | | V |

| | | | | | | |
|---|---|---|---|---|---|---|
| | voltage | | | | | |
| IOUT | Output current | Nch<br>VDS=0.05V，VDD=0.7V | 0.01 | 0.05 | | mA |
| | | Pch<br>VDS=-2.1V，VDD=4.50V | 1.0 | 2.0 | | mA |
| TPLH | Output Delay Time | | | | 20 | uS |

- BL8506-44C/NXX（4.4V） (Topt＝25℃,Unless otherwise specified.)

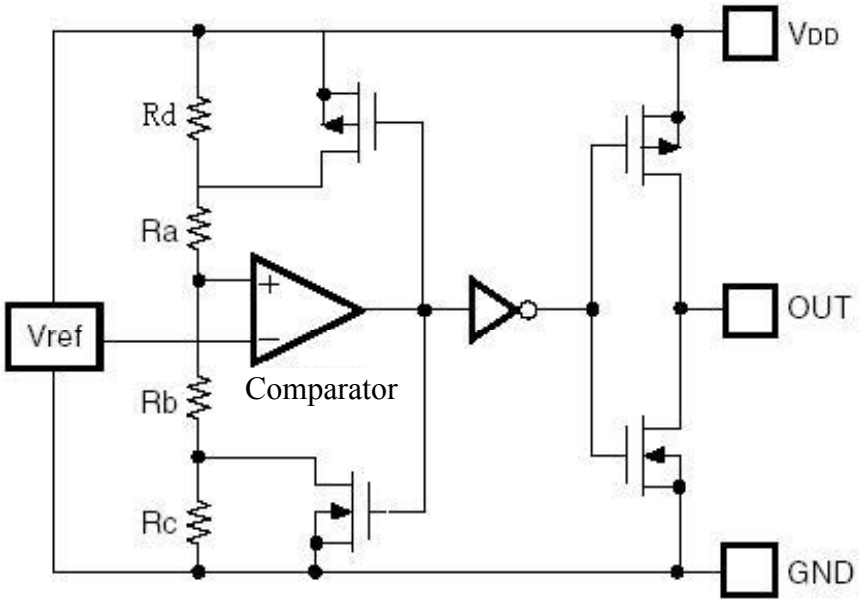
| Symbol | Parameter | Conditions | Reference data | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| -VDET | Detector Threshold | | 4.312 | 4.4 | 4.488 | V |
| VHYS | Detector Threshold Hysteresis | | 0.088 | 0.176 | 0.264 | V |
| ISS | Current consumption | VDD=6.4V | | 0.5 | 1 | uA |
| VDDH | Maximum operating voltage | | | | 10 | V |
| VDDL | Minimum Operating voltage | | | 0.5 | | V |
| IOUT | Output current | Nch<br>VDS=0.05V，VDD=0.7V | 0.01 | 0.05 | | mA |
| | | Pch<br>VDS=-2.1V，VDD=8.0V | 1.5 | 3.0 | | mA |
| TPLH | Output Delay Time | | | | 20 | uS |

## Electrical Characteristics By Detector Threshold

| Part Number | Detector Threshold -Vdet[V] | | | Detector Threshold Hysteresis Vhys[V] | | | Supply Current1 Iss1[uA] | | | Supply Current2 Iss2[uA] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Min. | Typ. | Max. | Min. | Typ. | Max. | Condition | Typ. | Max. | Condition | Typ. | Max. |
| BL8506-09XXX | 0.882 | 0.900 | 0.918 | 0.018 | 0.036 | 0.054 | Vdd= (-Vdet) +0.1V | 0.5 | 1.0 | Vdd= (-Vdet) +2V | 1.0 | 1.5 |
| BL8506-10XXX | 0.980 | 1.000 | 1.020 | 0.020 | 0.040 | 0.060 | | | | | | |
| BL8506-11XXX | 1.078 | 1.100 | 1.122 | 0.022 | 0.044 | 0.066 | | | | | | |
| BL8506-12XXX | 1.176 | 1.200 | 1.224 | 0.024 | 0.048 | 0.072 | | | | | | |
| BL8506-13XXX | 1.274 | 1.300 | 1.326 | 0.026 | 0.052 | 0.078 | | | | | | |
| BL8506-14XXX | 1.372 | 1.400 | 1.428 | 0.028 | 0.056 | 0.084 | | | | | | |
| BL8506-15XXX | 1.470 | 1.500 | 1.530 | 0.030 | 0.060 | 0.090 | | | | | | |
| BL8506-16XXX | 1.568 | 1.600 | 1.632 | 0.032 | 0.064 | 0.096 | | | | | | |
| BL8506-17XXX | 1.666 | 1.700 | 1.734 | 0.034 | 0.068 | 0.102 | | | | | | |
| BL8506-18XXX | 1.764 | 1.800 | 1.836 | 0.036 | 0.072 | 0.108 | | | | | | |
| BL8506-19XXX | 1.862 | 1.900 | 1.938 | 0.038 | 0.076 | 0.114 | | | | | | |
| BL8506-20XXX | 1.960 | 2.000 | 2.040 | 0.040 | 0.080 | 0.120 | | | | | 0.5 | 1.0 |
| BL8506-21XXX | 2.058 | 2.100 | 2.142 | 0.042 | 0.084 | 0.126 | | | | | | |
| BL8506-22XXX | 2.156 | 2.200 | 2.244 | 0.044 | 0.088 | 0.132 | | | | | | |
| BL8506-23XXX | 2.254 | 2.300 | 2.346 | 0.046 | 0.092 | 0.138 | | | | | | |
| BL8506-24XXX | 2.352 | 2.400 | 2.448 | 0.048 | 0.096 | 0.144 | | | | | | |
| BL8506-25XXX | 2.450 | 2.500 | 2.550 | 0.050 | 0.100 | 0.150 | | | | | | |
| BL8506-26XXX | 2.548 | 2.600 | 2.652 | 0.052 | 0.104 | 0.156 | | | | | | |
| BL8506-27XXX | 2.646 | 2.700 | 2.754 | 0.054 | 0.108 | 0.162 | | | | | | |
| BL8506-28XXX | 2.744 | 2.800 | 2.856 | 0.056 | 0.112 | 0.168 | | | | | | |
| BL8506-29XXX | 2.842 | 2.900 | 2.958 | 0.058 | 0.116 | 0.174 | | | | | | |
| BL8506-30XXX | 2.940 | 3.000 | 3.060 | 0.060 | 0.120 | 0.180 | | | | | | |
| BL8506-31XXX | 3.038 | 3.100 | 3.162 | 0.062 | 0.124 | 0.186 | | | | | | |
| BL8506-32XXX | 3.136 | 3.200 | 3.264 | 0.064 | 0.128 | 0.192 | | | | | | |
| BL8506-33XXX | 3.234 | 3.300 | 3.366 | 0.066 | 0.132 | 0.198 | | | | | | |
| BL8506-34XXX | 3.332 | 3.400 | 3.468 | 0.068 | 0.136 | 0.204 | | | | | | |
| BL8506-35XXX | 3.430 | 3.500 | 3.570 | 0.070 | 0.140 | 0.210 | | | | | | |
| BL8506-36XXX | 3.528 | 3.600 | 3.672 | 0.072 | 0.144 | 0.216 | | | | | | |
| BL8506-37XXX | 3.626 | 3.700 | 3.774 | 0.074 | 0.148 | 0.222 | | | | | | |
| BL8506-38XXX | 3.724 | 3.800 | 3.876 | 0.076 | 0.152 | 0.228 | | | | | | |
| BL8506-39XXX | 3.822 | 3.900 | 3.978 | 0.078 | 0.156 | 0.234 | | | | | | |
| BL8506-40XXX | 3.920 | 4.000 | 4.080 | 0.080 | 0.160 | 0.240 | | | | | | |
| BL8506-41XXX | 4.018 | 4.100 | 4.182 | 0.082 | 0.164 | 0.246 | | | | | | |
| BL8506-42XXX | 4.116 | 4.200 | 4.284 | 0.084 | 0.168 | 0.252 | | | | | | |
| BL8506-43XXX | 4.214 | 4.300 | 4.386 | 0.086 | 0.172 | 0.258 | | | | | | |
| BL8506-44XXX | 4.312 | 4.400 | 4.488 | 0.088 | 0.176 | 0.264 | | | | | | |
| BL8506-45XXX | 4.410 | 4.500 | 4.590 | 0.090 | 0.180 | 0.270 | | | | | | |
| BL8506-46XXX | 4.508 | 4.600 | 4.692 | 0.092 | 0.184 | 0.276 | | | | | | |
| BL8506-47XXX | 4.606 | 4.700 | 4.794 | 0.094 | 0.188 | 0.282 | | | | | | |
| BL8506-48XXX | 4.704 | 4.800 | 4.896 | 0.096 | 0.192 | 0.288 | | | | | | |
| BL8506-49XXX | 4.802 | 4.900 | 4.998 | 0.098 | 0.196 | 0.294 | | | | | | |
| BL8506-50XXX | 4.900 | 5.000 | 5.100 | 0.100 | 0.200 | 0.300 | | | | | | |
| BL8506-51XXX | 4.998 | 5.100 | 5.202 | 0.102 | 0.204 | 0.306 | | | | | | |
| BL8506-52XXX | 5.096 | 5.200 | 5.304 | 0.104 | 0.208 | 0.312 | | | | | | |
| BL8506-53XXX | 5.194 | 5.300 | 5.406 | 0.106 | 0.212 | 0.318 | | | | | | |
| BL8506-54XXX | 5.292 | 5.400 | 5.508 | 0.108 | 0.216 | 0.324 | | | | | | |
| BL8506-55XXX | 5.390 | 5.500 | 5.610 | 0.110 | 0.220 | 0.330 | | | | | | |
| BL8506-56XXX | 5.488 | 5.600 | 5.712 | 0.112 | 0.224 | 0.336 | | | | | | |
| BL8506-57XXX | 5.586 | 5.700 | 5.814 | 0.114 | 0.228 | 0.342 | | | | | | |
| BL8506-58XXX | 5.684 | 5.800 | 5.916 | 0.116 | 0.232 | 0.348 | | | | | | |
| BL8506-59XXX | 5.782 | 5.900 | 6.018 | 0.118 | 0.236 | 0.354 | | | | | | |
| BL8506-60XXX | 5.880 | 6.000 | 6.120 | 0.120 | 0.240 | 0.360 | | | | | | |

| Output Current1 | | | Output Current2 | | | | Output Delay Time | Minimum Operating Voltage | | Detector Threshold Temperature Coefficient | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Iout1[mA] | | | Iout2[mA] | | | | $T_{PLH}$[us] | $V_{DDL}$[V] | | $\Delta$-$V_{DET}$/$\Delta$Tppm/°C | |
| Condition | Min. | Typ. | Condition | | Min. | Typ. | Max. | Typ. | Max. | Condition | Typ. |
| NCH, $V_{DS}$=0.05V, $V_{DD}$=0.7V | 0.01 | 0.05 | NCH, $V_{DS}$=0.5V | Vdd=0.85V | 0.1 | 0.5 | 20 | 0.5 | 0.7 | -40°C≤ Topt ≤85°C | ±100 |
| | | | | Vdd=1.0V | 0.2 | 1.0 | | | | | |
| | | | | $V_{DD}$=1.5V | 1.0 | 2.0 | | | | | |

**Function description:**



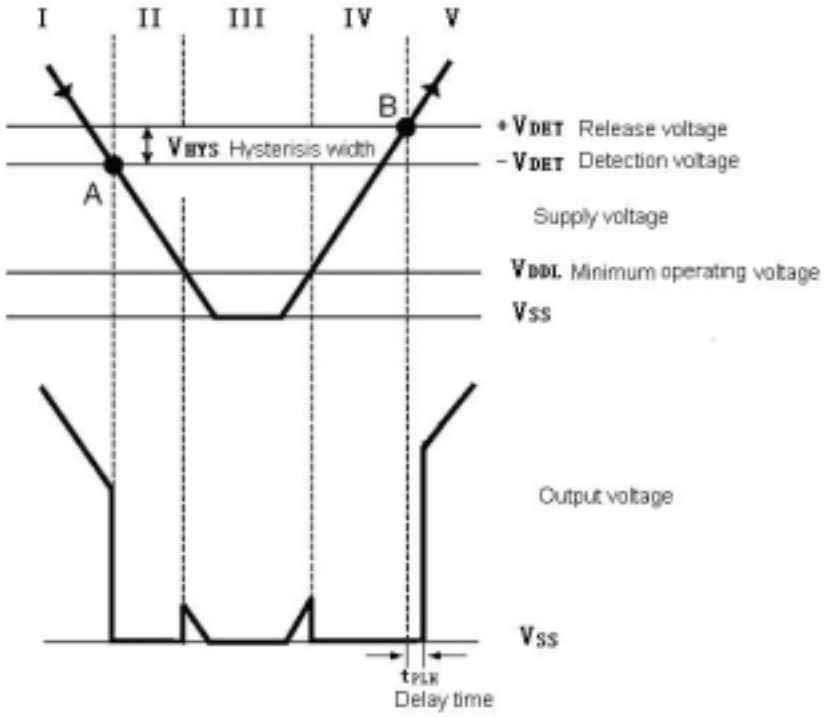

High precision low temperature co-efficiency reference voltage is applied to the negative input of a comparator. Input voltage, divided by resistor array of Ra Rb and Rc, is applied to the positive input of the comparator. Output of the comparator controls a pair of NMOS and PMOS switches, generating the hysteresis. Output of the comparator passes a series of buffer to drive the output CMOS pair.

+ $V_{DET}$，- $V_{DET}$，$V_{HYS}$ can be calculated as follows:

- $V_{DET} = V_{REF}*(1+Ra/(Rb+Rc))$

+ $V_{DET} = V_{REF}*(1+(Ra+Rd)/Rb) = V_{REF}*(1+(Ra+Rc)/Rb)$

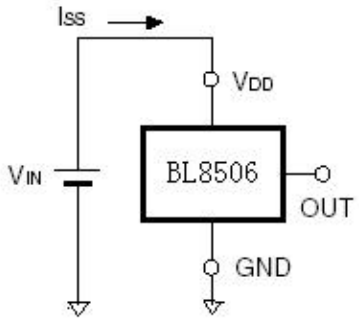
$V_{HYS} = +V_{DET} - (-V_{DET}) = V_{REF}*(Ra+Rb+Rc)(1/Rb-1/(Rb+Rc))$



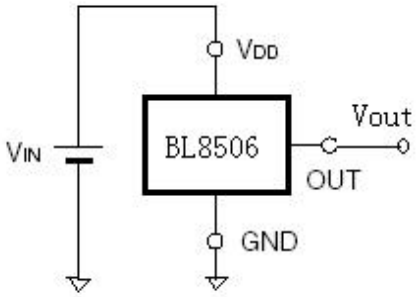

| No. | Operation status | Output status |
|---|---|---|
| I | $V_{DD}$>-$V_{DET}$ | Output voltage is equal to the supply voltage |
| II | $V_{DD}$ drops below - $V_{DET}$ | Output voltage equals to GND level |
| III | $V_{DD}$ drops further below $V_{DDL}$ | Output voltage is undefined |
| IV | $V_{DD}$ rises above $V_{DDL}$ | Output voltage equals to GND level |
| V | $V_{DD}$ rises above + $V_{DET}$ | Output voltage equals to supply voltage，$V_{HYS}$=(+ $V_{DET}$)-(- $V_{DET}$) |

**Test circuits：**

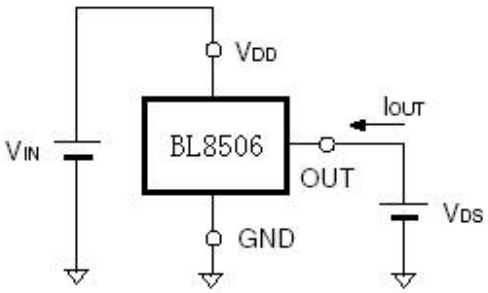
（1）Supply current test circuit



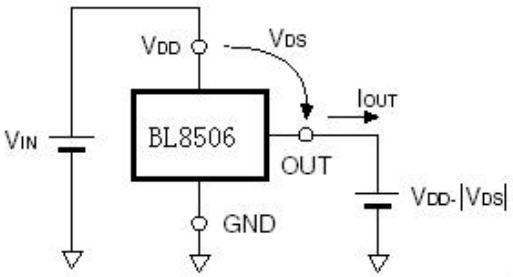

（2）Detector threshold test circuit




（3）NCH Drive Output Current Test Circuit



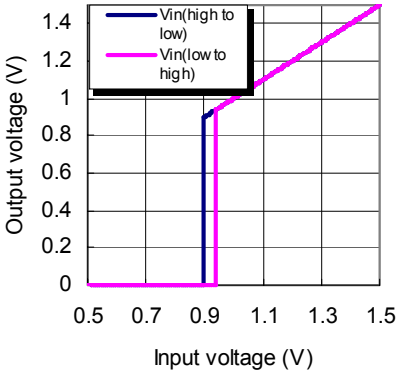

（4）PCH Drive Output Current Test Circuit



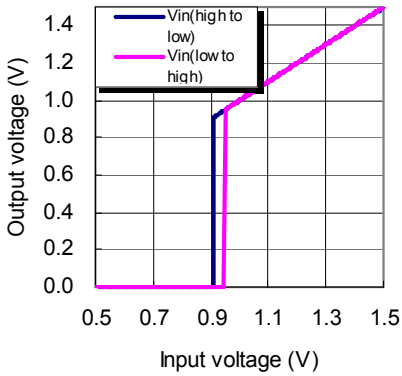
## Typical Performance Characteristics：

1) Output voltage VS. Input voltage

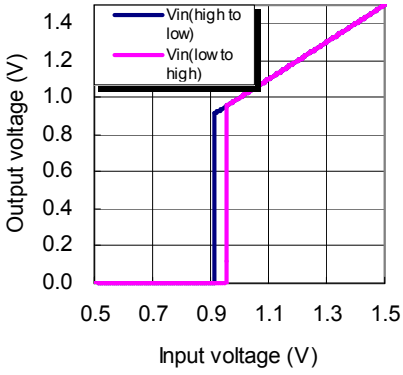
**Detector threshold= 0.9V （-40°C）**



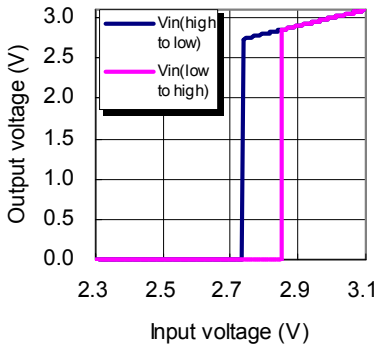

**Detector threshold= 0.9V （25°C）**



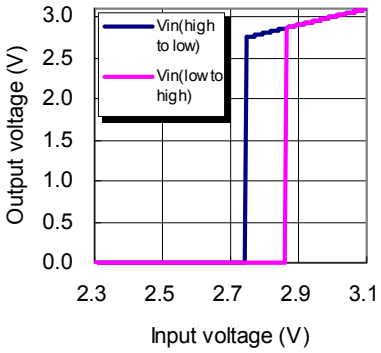

**Detector threshold= 0.9V （70°C）**



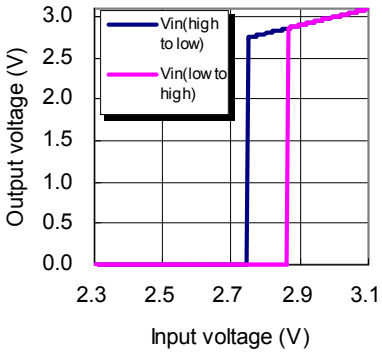

Detector threshold=2.7V （-40°C）



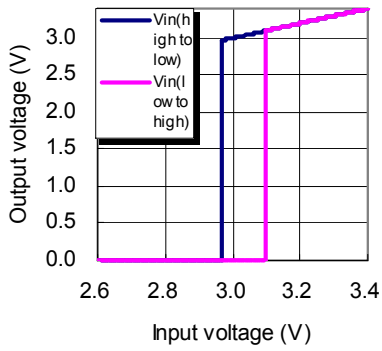

Detector threshold=2.7V （25°C）



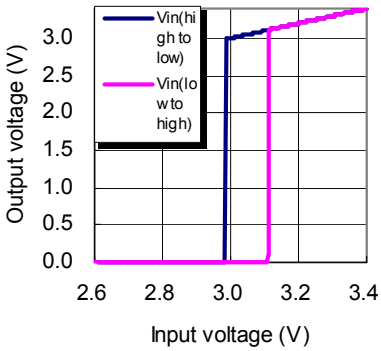

Detector threshold=2.7V （70°C）



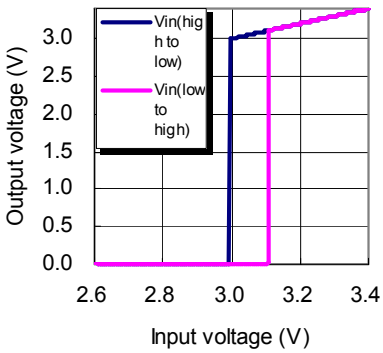

Detector threshold=3.0V （-40°C）



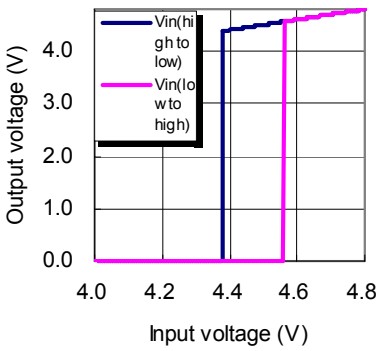

Detector threshold=3.0V （25°C）



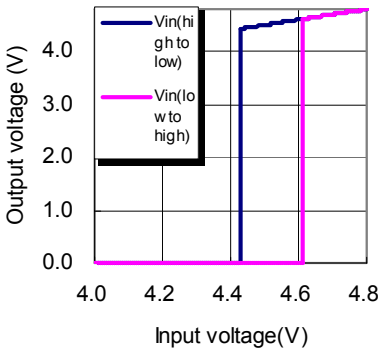

Detector threshold=3.0V （70°C）



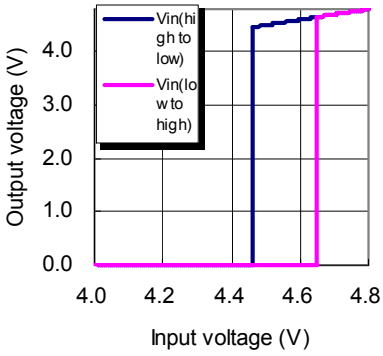
Detector threshold=4.4V（-40°C）




Detector threshold=4.4V（25°C）

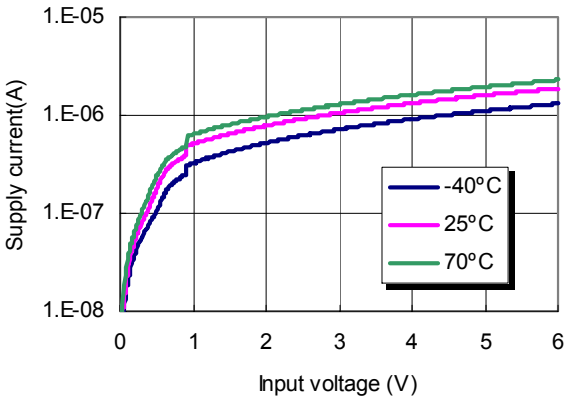



Detector threshold=4.4V（70°C）

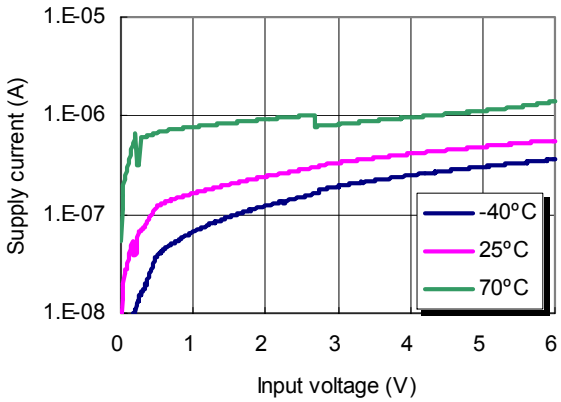



## 2) Supply current VS. Input voltage

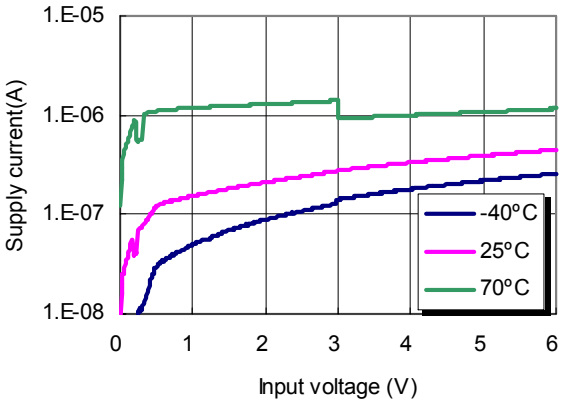
Detector threshold= 0.9V



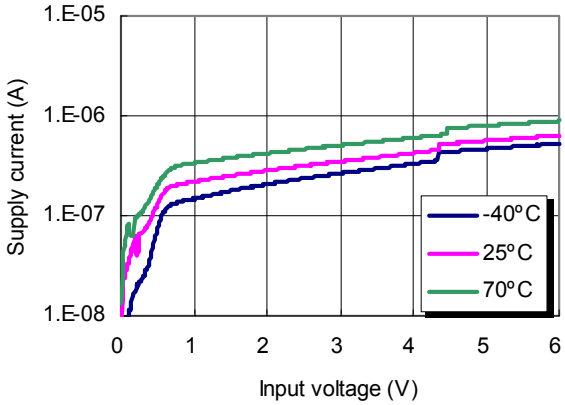

Detector threshold=2.7V




Detector threshold=3.0V

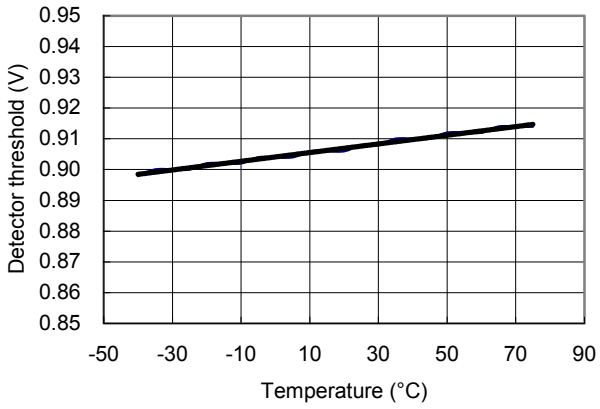



Detector threshold=4.4V

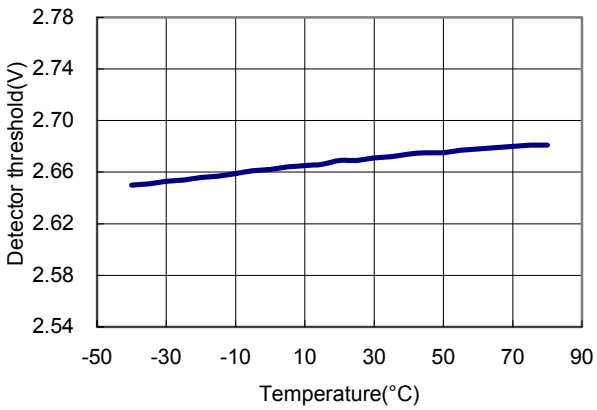



## 3) Detector Threshold Hysteresis VS. Temperature

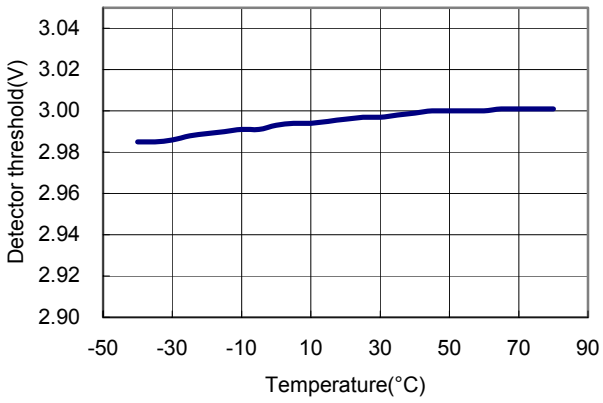
Detector threshold= 0.9V



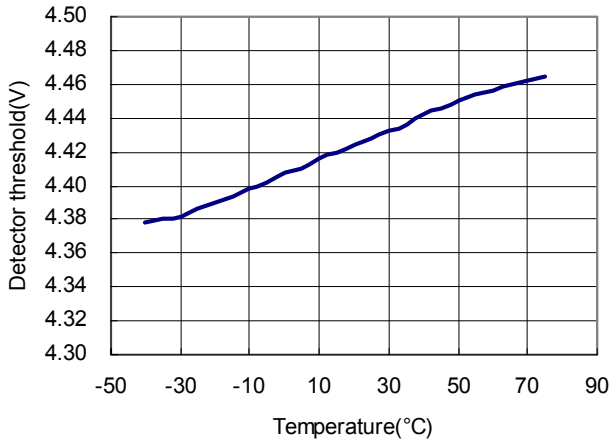

Detector threshold=2.7V




Detector threshold=3.0V

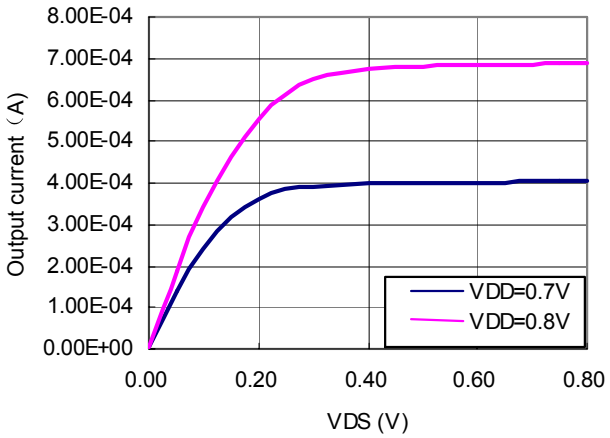



Detector threshold=4.4V

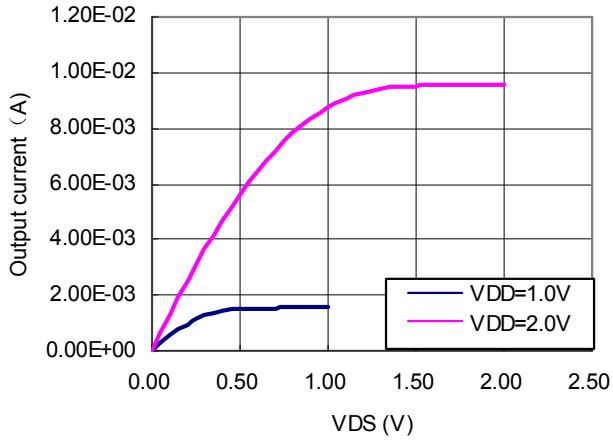


4）Nch Driver Output Current VS. $V_{DS}$

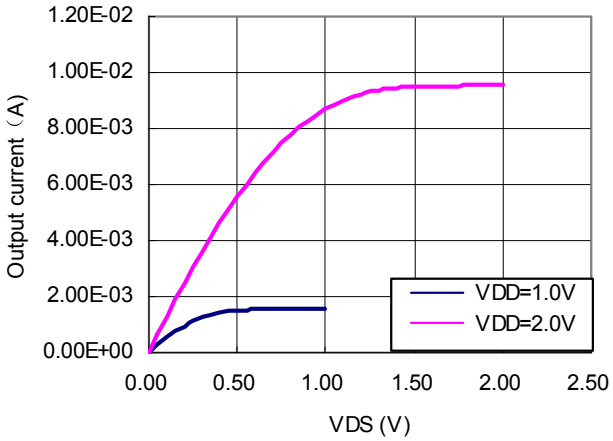
**BL8506-09CXX**



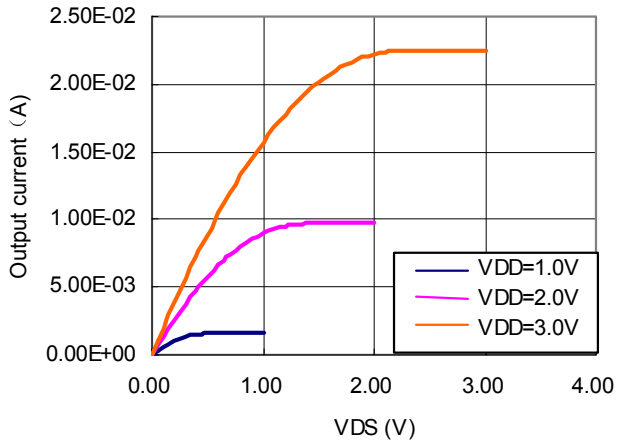

**BL8506-27CXX**




**BL8506-30CXX**

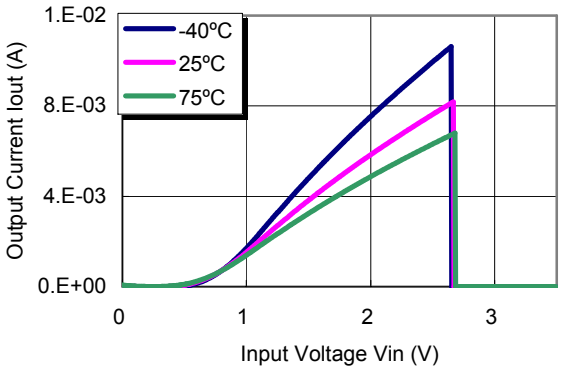



**BL8506-44CXX**

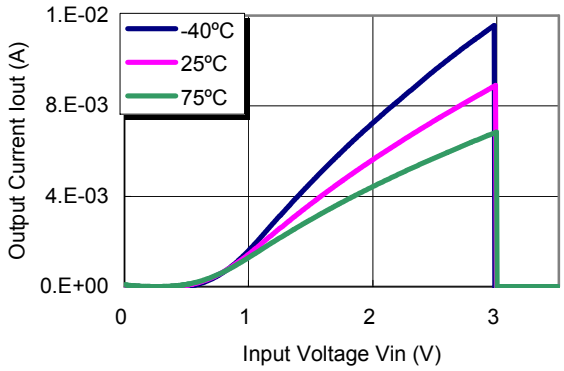


5）NCH Driver Output Current vs. Input Voltage

Detector threshold=2.7V

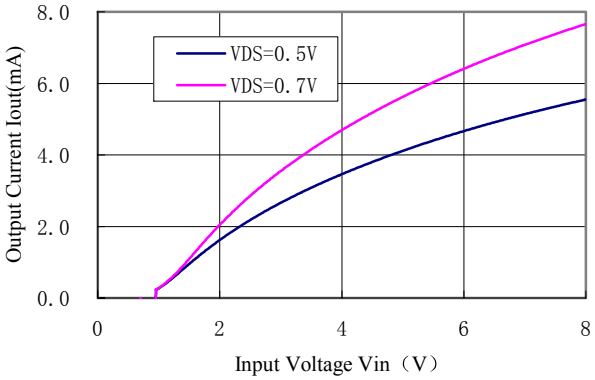



Detector threshold=3.0V

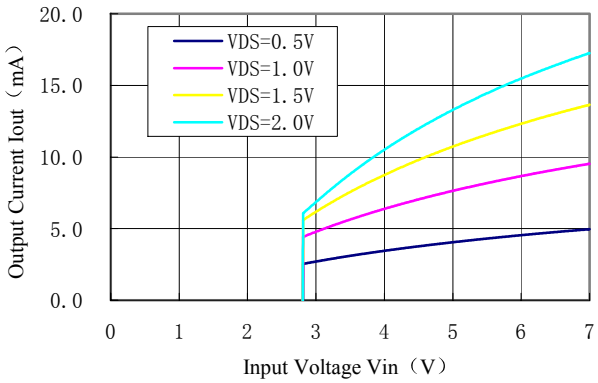



6）PCH Driver Output Current vs. Input Current

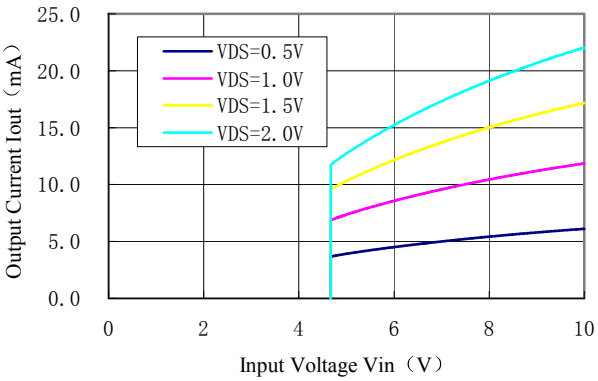
Detector threshold=0. 9V



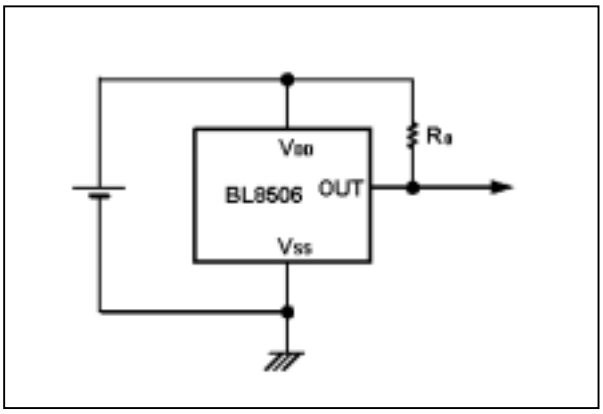

Detector threshold=2. 7V




Detector threshold=4. 4V



## Typical applications：




Note：

1. $R_0$ is unnecessary for CMOS output products.
2. The value of $R_0$ need to be selected in different application, Typical value is 470kΩ