

## High-Precision Low Voltage Detector

### DESCRIPTION

BL8506 is a series of high precision voltage detector with ultra-low current consumption (500nA typ. at  $V_{DD}=3.0V$ ). 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 forms of output, CMOS and N-channel open-drain, are available.

BL8506 is available in SOT23, SOT23-3, SOT23-5, SC-82, SOT89-3, TO-92 packages which are Pb-free.

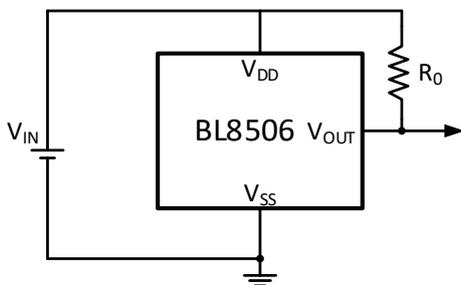
### FEATURES

- High-precision detection voltage:  $\pm 2\%$
- Detection voltage: 0.9V~6.0V (in 0.1V step)
- 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 (active low) or  
N-channel open-drain (active low)

### APPLICATIONS

- 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

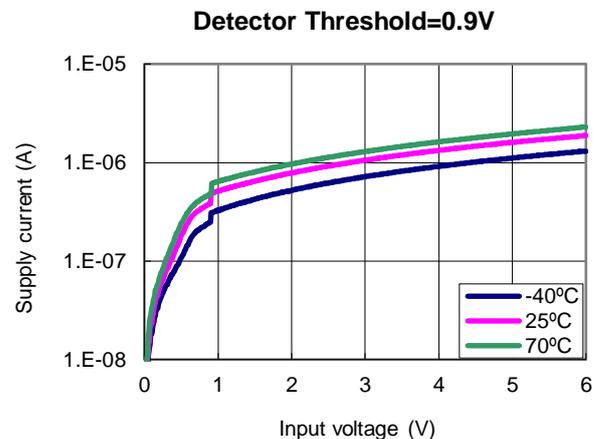
### TYPICAL APPLICATION



**Note:**

$R_0$  is unnecessary for CMOS output products.  
The value of  $R_0$  need to be selected in different applications and the typical value is 470K $\Omega$ .

### ELECTRICAL CHARACTERISTICS



# BL8506

## ORDERING INFORMATION

BL8506-**1** **2** **3**

Code	Description
<b>1</b>	Detector voltage: e.g., 09=0.9V 27=2.7V 60=6.0V
<b>2</b>	Output form: C: CMOS N: Nch open-drain
<b>3</b>	Package type: RO: SOT23 RM: SOT23-3 RN: SOT23-5 RP: SC-82 SM: SOT89-3 T: TO-92

## ABSOLUTE MAXIMUM RATING

Parameter	Value	
Input voltage	-0.3V to 10V	
Output voltage range	-0.3V to 12V	
Maximum output current	70mA	
Ambient temperature (T <sub>A</sub> )	-40°C to 85°C	
Power dissipation	SOT23	250mW
	SOT23-3	250mW
	SOT23-5	250mW
	SC-82	200mW
	SOT89-3	500mW
TO-92	600mW	
Storage temperature (T <sub>S</sub> )	-40°C to 150°C	
Lead temperature & time	260°C, 10s	

**Note:** Exceed these limits to damage to the device.

Exposure to absolute maximum rating conditions may affect device reliability.

## PIN CONFIGURATION

Product Classification	BL8506-□□□RO
Marking	<p>SOT23</p>
C6XX or N6XX	
C: CMOS N: Nch 6: Product code XX: Detector voltage	

Product classification		BL8506-□□□RM
C6XX or N6XX	C: CMOS N: Nch 6: Product code XX: Detector voltage	<p>SOT23-3</p>
Product classification		BL8506-□□□RN
C6XX or N6XX	C: CMOS N: Nch 6: Product code XX: Detector voltage	<p>SOT23-5</p>
Product classification		BL8506-□□□RP
C6XX or N6XX	C: CMOS N: Nch 6: Product code XX: Detector voltage	<p>SC-82</p>
Product classification		BL8506-□□□SM
OAXX YYCZZ or OAXX YYNZZ	OA: Product code XX: Detector voltage YY: Data code C: CMOS N: Nch ZZ: Date code	<p>SOT89-3</p>
Product classification		BL8506-□□□T
OAXX YYCZZ or OAXX YYNZZ	OA: Product code XX: Detector voltage YY: Data code C: CMOS OR N: Nch ZZ: Date code	<p>TO-92</p>
V <sub>SS</sub>	Ground pin	
V <sub>DD</sub>	Supply voltage input	
V <sub>OUT</sub>	Voltage detection output pin	
NC	No connection	

# BL8506

## RECOMMENDED WORK CONDITIONS

Item	Min	Recommended	Max	Units
Input voltage range	0.7		10	V
Ambient temperature	-40	25	85	°C

## ELECTRICAL CHARACTERISTICS

BL8506-09C/NXX (0.9V)

T<sub>A</sub>=25°C, unless otherwise specified.

Symbol	Parameter	Conditions	Reference data			Units
			Min	Typ	Max	
-V <sub>DET</sub>	Detector threshold		0.882	0.9	0.918	V
V <sub>HYS</sub>	Detector threshold hysteresis		0.018	0.036	0.054	V
I <sub>SS</sub>	Current consumption	V <sub>DD</sub> =2.9V		1	2.5	uA
V <sub>DDH</sub>	Maximum operating voltage				10	V
V <sub>DDL</sub>	Minimum operating voltage			0.5		V
I <sub>OUT</sub>	Output current	Nch V <sub>DS</sub> =0.05V, V <sub>DD</sub> =0.7V	0.01	0.05		mA
		V <sub>DS</sub> =0.50V, V <sub>DD</sub> =0.8V	0.05	0.50		
		Pch V <sub>DS</sub> =-2.1V, V <sub>DD</sub> =4.50V	1.0	2.0		mA
T <sub>PLH</sub>	Output delay time				20	us

BL8506-25C/NXX (2.5V)

T<sub>A</sub>=25°C, unless otherwise specified.

Symbol	Parameter	Conditions	Reference data			Units
			Min	Typ	Max	
-V <sub>DET</sub>	Detector threshold		2.450	2.5	2.550	V
V <sub>HYS</sub>	Detector threshold hysteresis		0.050	0.100	0.150	V
I <sub>SS</sub>	Current consumption	V <sub>DD</sub> =4.5V		1	2.5	uA
V <sub>DDH</sub>	Maximum operating voltage				10	V
V <sub>DDL</sub>	Minimum operating voltage			0.5		V
I <sub>OUT</sub>	Output current	Nch V <sub>DS</sub> =0.05V, V <sub>DD</sub> =0.70V	0.01	0.05		mA
		Pch V <sub>DS</sub> =-2.1V, V <sub>DD</sub> =4.50V	1.0	2.0		mA
T <sub>PLH</sub>	Output delay time				20	us

# BL8506

BL8506-27C/NXX (2.7V)

T<sub>A</sub>=25°C, unless otherwise specified.

Symbol	Parameter	Conditions	Reference data			Units
			Min	Typ	Max	
-V <sub>DET</sub>	Detector threshold		2.646	2.7	2.754	V
V <sub>HYS</sub>	Detector threshold hysteresis		0.054	0.108	0.162	V
I <sub>SS</sub>	Current consumption	V <sub>DD</sub> =4.7V		1	2.5	uA
V <sub>DDH</sub>	Maximum operating voltage				10	V
V <sub>DDL</sub>	Minimum operating voltage			0.5		V
I <sub>OUT</sub>	Output current	Nch V <sub>DS</sub> =0.05V, V <sub>DD</sub> =0.70V	0.01	0.05		mA
		Pch V <sub>DS</sub> =-2.1V, V <sub>DD</sub> =4.50V	1.0	2.0		mA
T <sub>PLH</sub>	Output delay time				20	us

BL8506-30C/NXX (3.0V)

T<sub>A</sub>=25°C, unless otherwise specified.

Symbol	Parameter	Conditions	Reference data			Units
			Min	Typ	Max	
-V <sub>DET</sub>	Detector threshold		2.94	3.0	3.06	V
V <sub>HYS</sub>	Detector threshold hysteresis		0.060	0.12	0.18	V
I <sub>SS</sub>	Current consumption	V <sub>DD</sub> =5.0V		1	2.5	uA
V <sub>DDH</sub>	Maximum operating voltage				10	V
V <sub>DDL</sub>	Minimum operating voltage			0.5		V
I <sub>OUT</sub>	Output current	Nch V <sub>DS</sub> =0.05V, V <sub>DD</sub> =0.7V	0.01	0.05		mA
		Pch V <sub>DS</sub> =-2.1V, V <sub>DD</sub> =4.50V	1.0	2.0		mA
T <sub>PLH</sub>	Output delay time				20	us

BL8506-34C/NXX (3.4V)

T<sub>A</sub>=25°C, unless otherwise specified.

Symbol	Parameter	Conditions	Reference data			Units
			Min	Typ	Max	
-V <sub>DET</sub>	Detector threshold		3.332	3.4	3.468	V
V <sub>HYS</sub>	Detector threshold hysteresis		0.068	0.136	0.204	V
I <sub>SS</sub>	Current consumption	V <sub>DD</sub> =5.4V		1	2.5	uA
V <sub>DDH</sub>	Maximum operating voltage				10	V
V <sub>DDL</sub>	Minimum operating voltage			0.5		V
I <sub>OUT</sub>	Output current	Nch V <sub>DS</sub> =0.05V, V <sub>DD</sub> =0.7V	0.01	0.05		mA
		Pch V <sub>DS</sub> =-2.1V, V <sub>DD</sub> =4.50V	1.0	2.0		mA
T <sub>PLH</sub>	Output delay time				20	us

# BL8506

BL8506-44C/NXX (4.4V)

T<sub>A</sub>=25°C, unless otherwise specified.

Symbol	Parameter	Conditions	Reference data			Units
			Min	Typ	Max	
-V <sub>DET</sub>	Detector threshold		4.312	4.4	4.488	V
V <sub>HYS</sub>	Detector threshold hysteresis		0.088	0.176	0.264	V
I <sub>SS</sub>	Current consumption	V <sub>DD</sub> =6.4V		1	2.5	uA
V <sub>DDH</sub>	Maximum operating voltage				10	V
V <sub>DDL</sub>	Minimum operating voltage			0.5		V
I <sub>OUT</sub>	Output current	Nch V <sub>DS</sub> =0.05V, V <sub>DD</sub> =0.7V	0.01	0.05		mA
		Pch V <sub>DS</sub> =-2.1V, V <sub>DD</sub> =8.0V	1.5	3.0		mA
T <sub>PLH</sub>	Output delay time				20	us

# BL8506

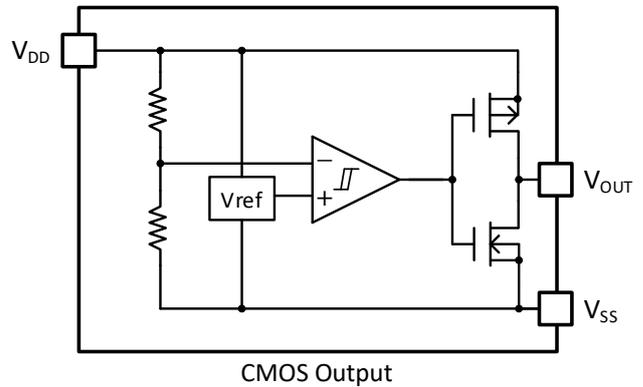
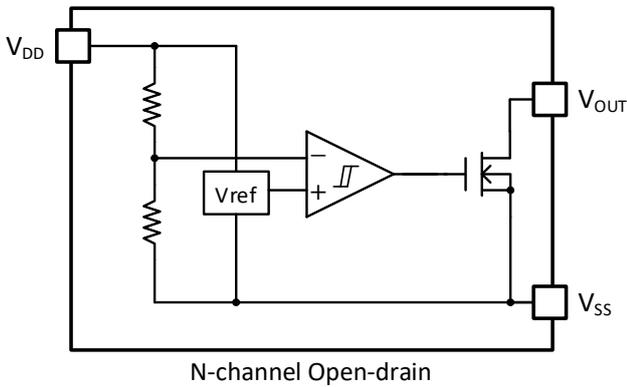
## ELECTRICAL CHARACTERISTICS BY DETECTOR THRESHOLD

Part Number	Detector Threshold			Detector Threshold Hysteresis			Supply Current1			Supply Current2		
	$-V_{DET}[V]$			$V_{HYS}[V]$			$I_{SS1}[\mu A]$			$I_{SS2}[\mu A]$		
	Min	Typ	Max	Min	Typ	Max	Condition	Typ	Max	Condition	Typ	Max
BL8506-09C/NXX	0.882	0.900	0.918	0.018	0.036	0.054	$V_{DD} = (-V_{DET}) + 0.1V$	0.5	2.5	1.0	2.5	
BL8506-10C/NXX	0.980	1.000	1.020	0.020	0.040	0.060						
BL8506-11C/NXX	1.078	1.100	1.122	0.022	0.044	0.066						
BL8506-12C/NXX	1.176	1.200	1.224	0.024	0.048	0.072						
BL8506-13C/NXX	1.274	1.300	1.326	0.026	0.052	0.078						
BL8506-14C/NXX	1.372	1.400	1.428	0.028	0.056	0.084						
BL8506-15C/NXX	1.470	1.500	1.530	0.030	0.060	0.090						
BL8506-16C/NXX	1.568	1.600	1.632	0.032	0.064	0.096						
BL8506-17C/NXX	1.666	1.700	1.734	0.034	0.068	0.102						
BL8506-18C/NXX	1.764	1.800	1.836	0.036	0.072	0.108						
BL8506-19C/NXX	1.862	1.900	1.938	0.038	0.076	0.114						
BL8506-20C/NXX	1.960	2.000	2.040	0.040	0.080	0.120						
BL8506-21C/NXX	2.058	2.100	2.142	0.042	0.084	0.126						
BL8506-22C/NXX	2.156	2.200	2.244	0.044	0.088	0.132						
BL8506-23C/NXX	2.254	2.300	2.346	0.046	0.092	0.138						
BL8506-24C/NXX	2.352	2.400	2.448	0.048	0.096	0.144						
BL8506-25C/NXX	2.450	2.500	2.550	0.050	0.100	0.150						
BL8506-26C/NXX	2.548	2.600	2.652	0.052	0.104	0.156						
BL8506-27C/NXX	2.646	2.700	2.754	0.054	0.108	0.162						
BL8506-28C/NXX	2.744	2.800	2.856	0.056	0.112	0.168						
BL8506-29C/NXX	2.842	2.900	2.958	0.058	0.116	0.174						
BL8506-30C/NXX	2.940	3.000	3.060	0.060	0.120	0.180						
BL8506-31C/NXX	3.038	3.100	3.162	0.062	0.124	0.186						
BL8506-32C/NXX	3.136	3.200	3.264	0.064	0.128	0.192						
BL8506-33C/NXX	3.234	3.300	3.366	0.066	0.132	0.198						
BL8506-34C/NXX	3.332	3.400	3.468	0.068	0.136	0.204						
BL8506-35C/NXX	3.430	3.500	3.570	0.070	0.140	0.210						
BL8506-36C/NXX	3.528	3.600	3.672	0.072	0.144	0.216						
BL8506-37C/NXX	3.626	3.700	3.774	0.074	0.148	0.222						
BL8506-38C/NXX	3.724	3.800	3.876	0.076	0.152	0.228						
BL8506-39C/NXX	3.822	3.900	3.978	0.078	0.156	0.234						
BL8506-40C/NXX	3.920	4.000	4.080	0.080	0.160	0.240						
BL8506-41C/NXX	4.018	4.100	4.182	0.082	0.164	0.246						
BL8506-42C/NXX	4.116	4.200	4.284	0.084	0.168	0.252						
BL8506-43C/NXX	4.214	4.300	4.386	0.086	0.172	0.258						
BL8506-44C/NXX	4.312	4.400	4.488	0.088	0.176	0.264						
BL8506-45C/NXX	4.410	4.500	4.590	0.090	0.180	0.270						
BL8506-46C/NXX	4.508	4.600	4.692	0.092	0.184	0.276						
BL8506-47C/NXX	4.606	4.700	4.794	0.094	0.188	0.282						
BL8506-48C/NXX	4.704	4.800	4.896	0.096	0.192	0.288						
BL8506-49C/NXX	4.802	4.900	4.998	0.098	0.196	0.294						
BL8506-50C/NXX	4.900	5.000	5.100	0.100	0.200	0.300						
BL8506-51C/NXX	4.998	5.100	5.202	0.102	0.204	0.306						
BL8506-52C/NXX	5.096	5.200	5.304	0.104	0.208	0.312						
BL8506-53C/NXX	5.194	5.300	5.406	0.106	0.212	0.318						
BL8506-54C/NXX	5.292	5.400	5.508	0.108	0.216	0.324						
BL8506-55C/NXX	5.390	5.500	5.610	0.110	0.220	0.330						
BL8506-56C/NXX	5.488	5.600	5.712	0.112	0.224	0.336						
BL8506-57C/NXX	5.586	5.700	5.814	0.114	0.228	0.342						
BL8506-58C/NXX	5.684	5.800	5.916	0.116	0.232	0.348						
BL8506-59C/NXX	5.782	5.900	6.018	0.118	0.236	0.354						
BL8506-60C/NXX	5.880	6.000	6.120	0.120	0.240	0.360						

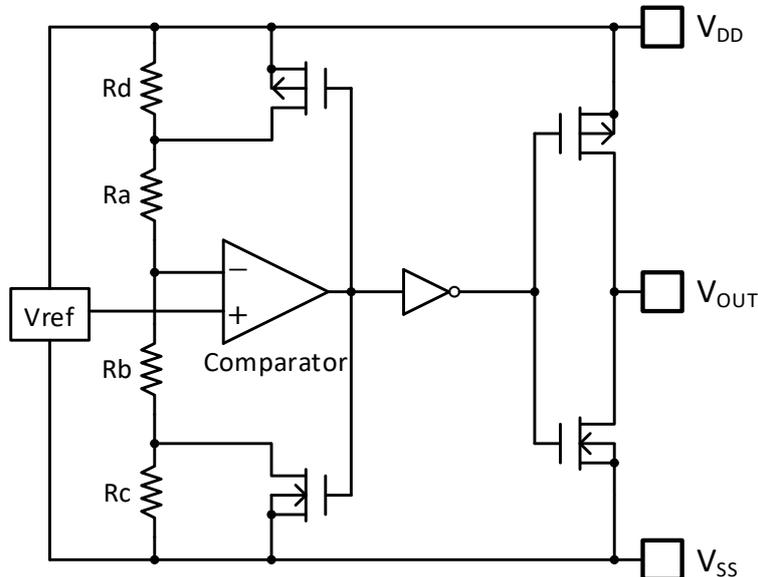
# BL8506

Output Current1			Output Current2			Output Delay Time	Minimum Operating Voltage		Detector Threshold Temperature Coefficient		
I <sub>OUT1</sub> [mA]			I <sub>OUT2</sub> [mA]			T <sub>PLH</sub> [us]	V <sub>DDL</sub> [V]		-V <sub>DET</sub> /T[ppm/°C]		
Condition	Min	Typ	Condition	Min	Typ	Max	Typ	Max	Condition	Typ	
NCH, V <sub>DS</sub> =0.05V, V <sub>DD</sub> =0.7V	0.01	0.05	NCH, V <sub>DS</sub> =0.5V	V <sub>DD</sub> =0.85V	0.1	0.5	20	0.5	0.7	-40°C to 85°C	100
				V <sub>DD</sub> =1.0V	0.2	1.0					
				V <sub>DD</sub> =1.5V	1.0	2.0					

## BLOCK DIAGRAM



## FUNCTION DESCRIPTION



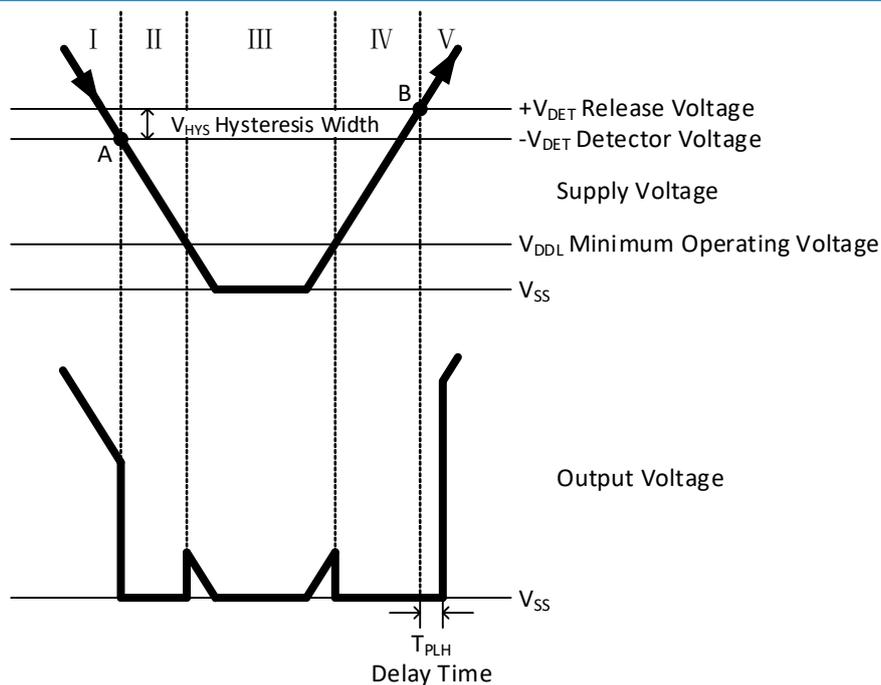
A high precision, low temperature coefficient reference voltage is applied to the positive input of the comparator. Input voltage, divided by resistor array of Ra, Rb and Rc, is applied to the negative input of the comparator. The output of the comparator controls a pair of PMOS and NMOS switches, generating the hysteresis. The 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:

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

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

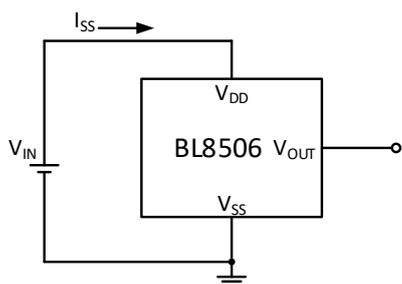
$$V_{HYS} = +V_{DET} - (-V_{DET}) = V_{REF} * (Ra + Rb + Rc) * [1/Rb - 1/(Rb + Rc)]$$



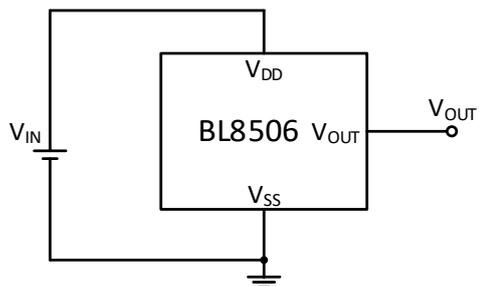
No.	Operation status	Output status
I	$V_{DD} > +V_{DET}$	Output voltage is equal to the supply voltage.
II	$V_{DD}$ drops below $-V_{DET}$	Output voltage equals to GND level.
III	$V_{DD}$ drops further below $V_{DDL}$	Output voltage is undefined.
IV	$V_{DD}$ rises above $V_{DDL}$	Output voltage equals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

## TEST CIRCUITS

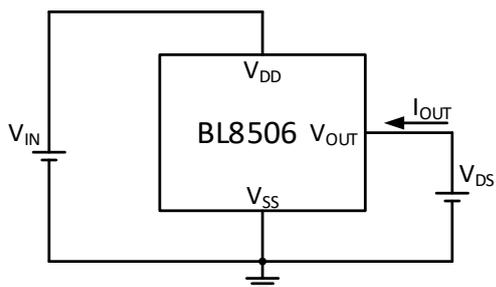
(1) Supply Current Test Circuit



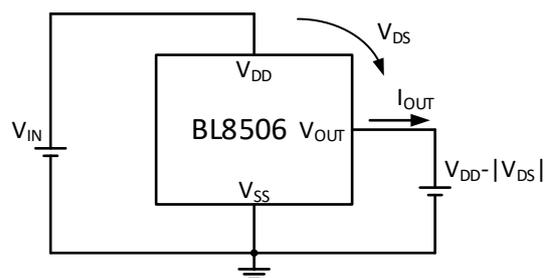
(2) Detector Threshold Test Circuit



(3) NCH Drive Output Current Test Circuit

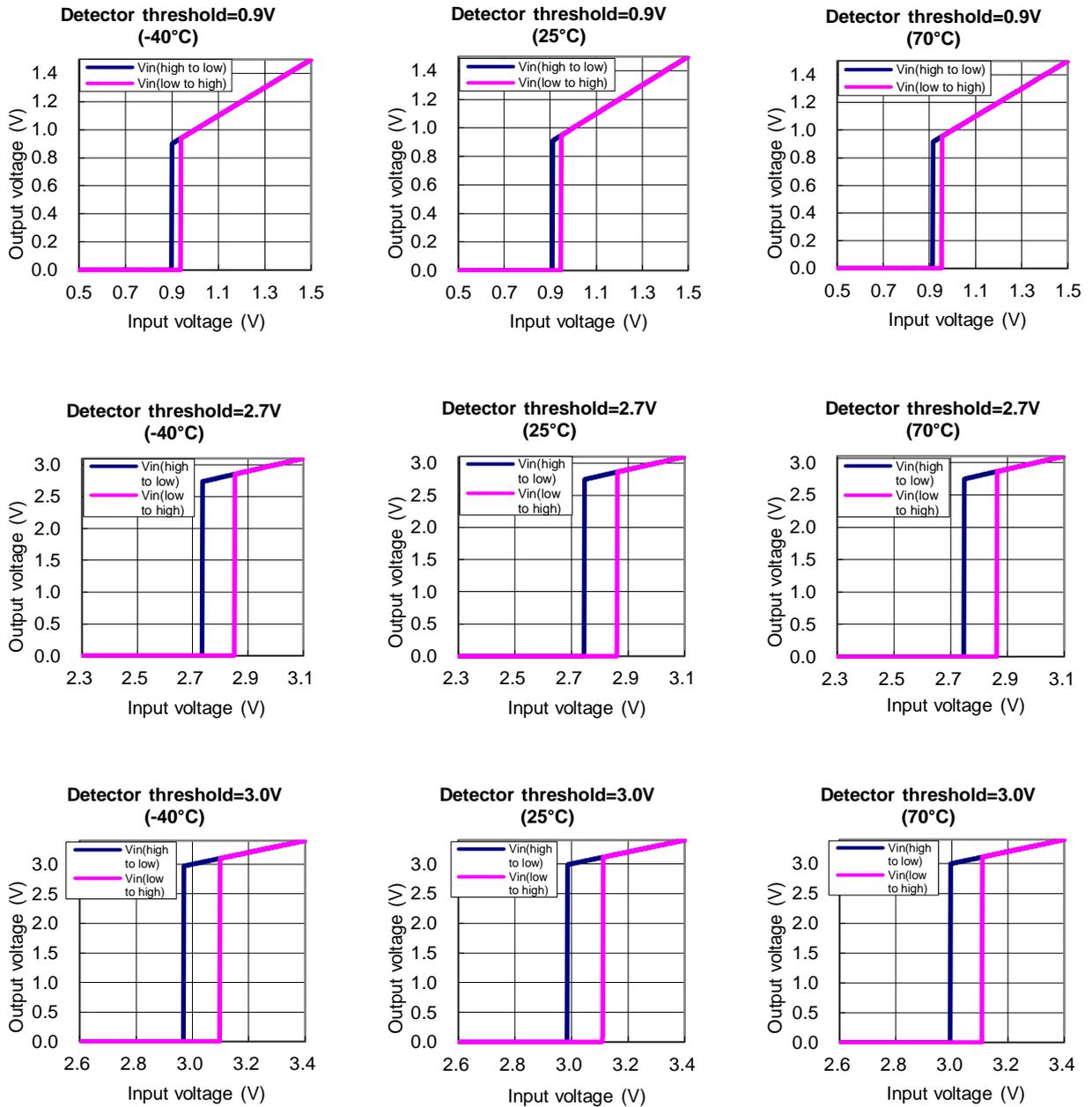


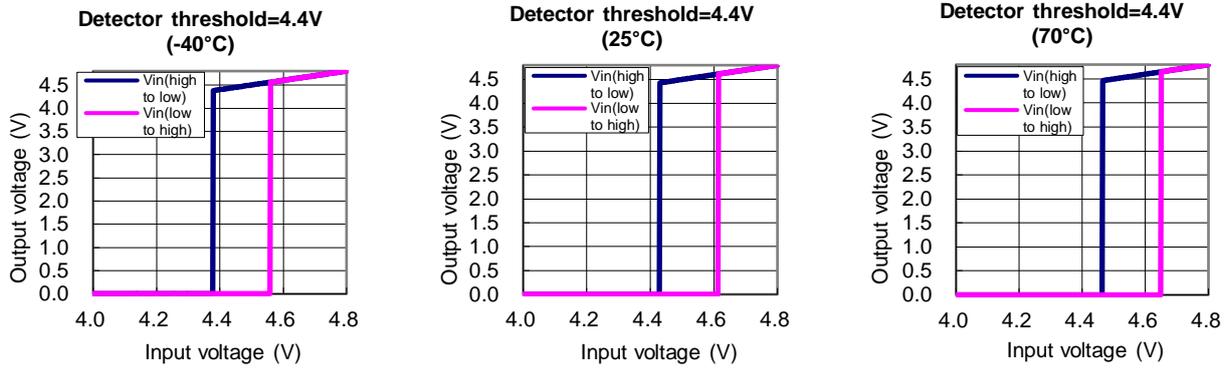
(4) PCH Drive Output Current Test Circuit



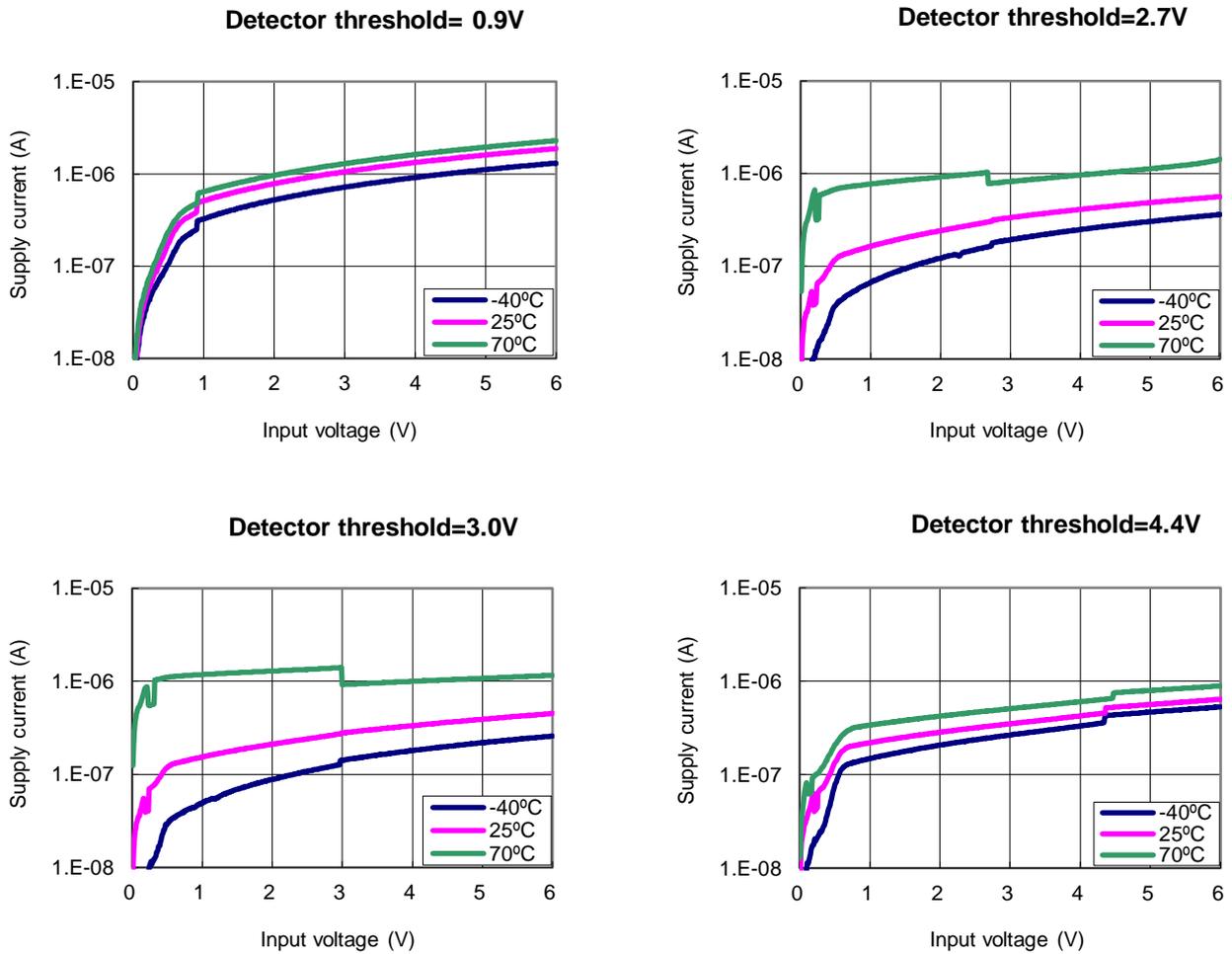
## TYPICAL PERFORMANCE CHARACTERISTICS

### 1) Output voltage vs. Input voltage



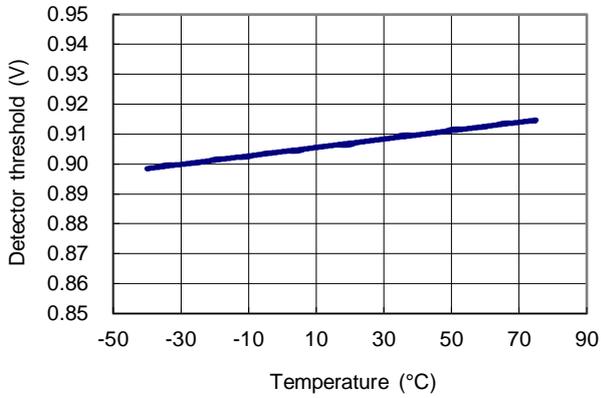


## 2) Supply current vs. Input voltage

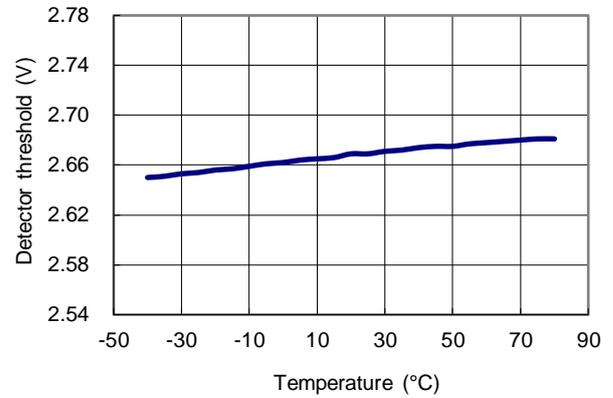


## 3) Detector threshold hysteresis vs. Temperature

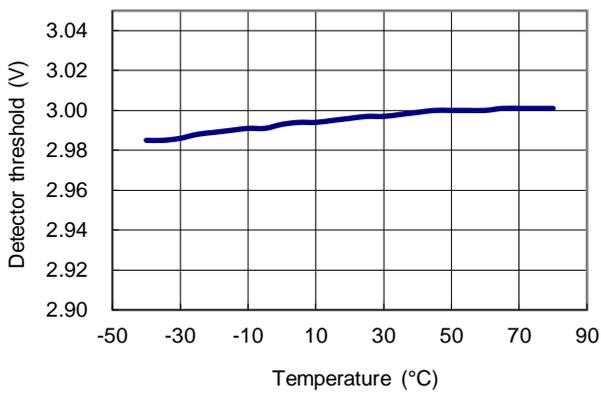
**Detector threshold=0.9V**



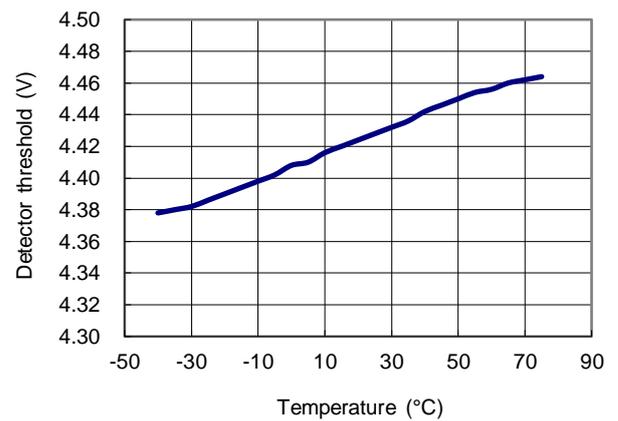
**Detector threshold=2.7V**



**Detector threshold=3.0V**

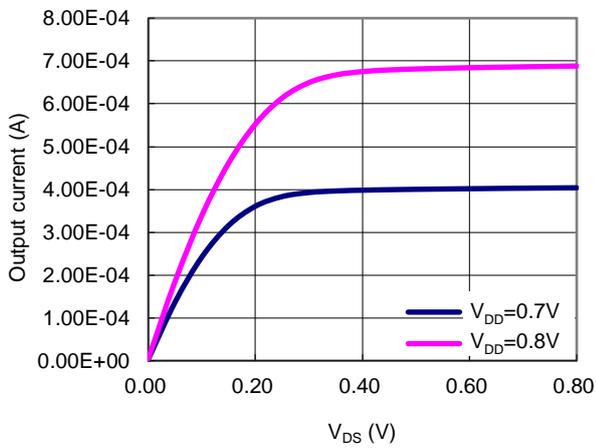


**Detector threshold=4.4V**

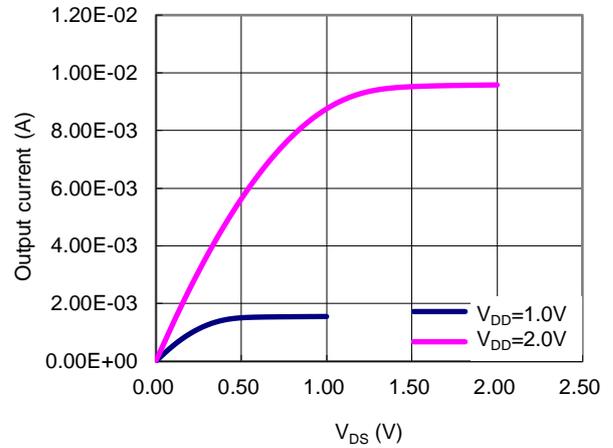


## 4) NCH driver output current vs. $V_{DS}$

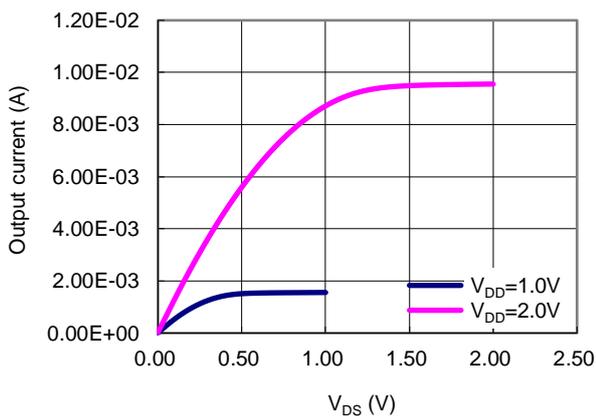
### BL8506-09CXX



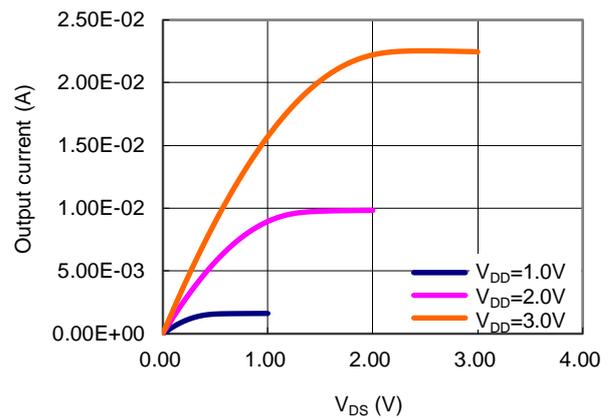
### BL8506-27CXX



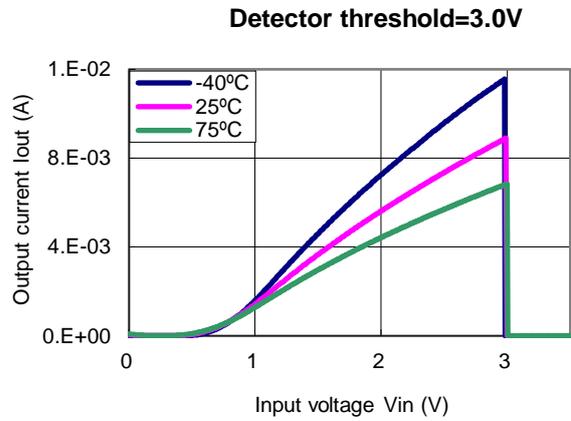
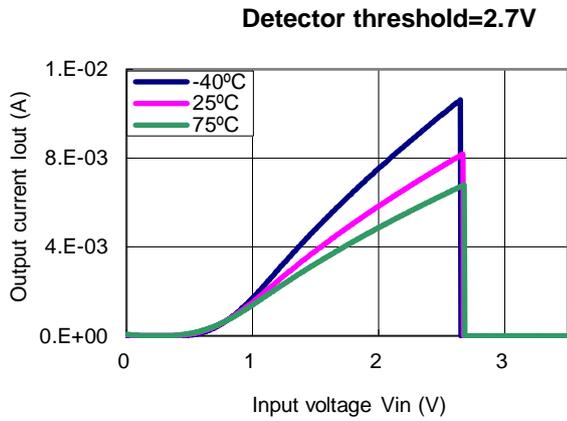
### BL8506-30CXX



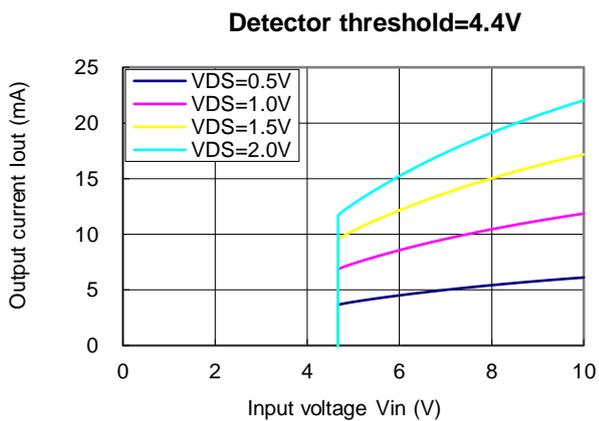
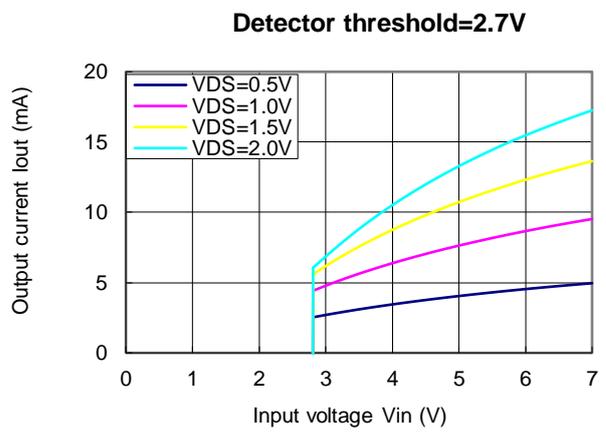
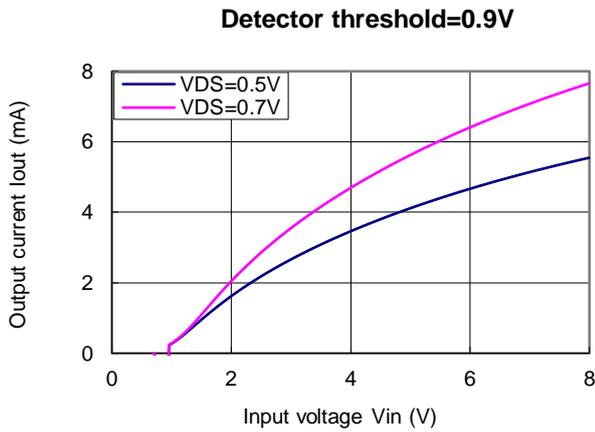
### BL8506-44CXX



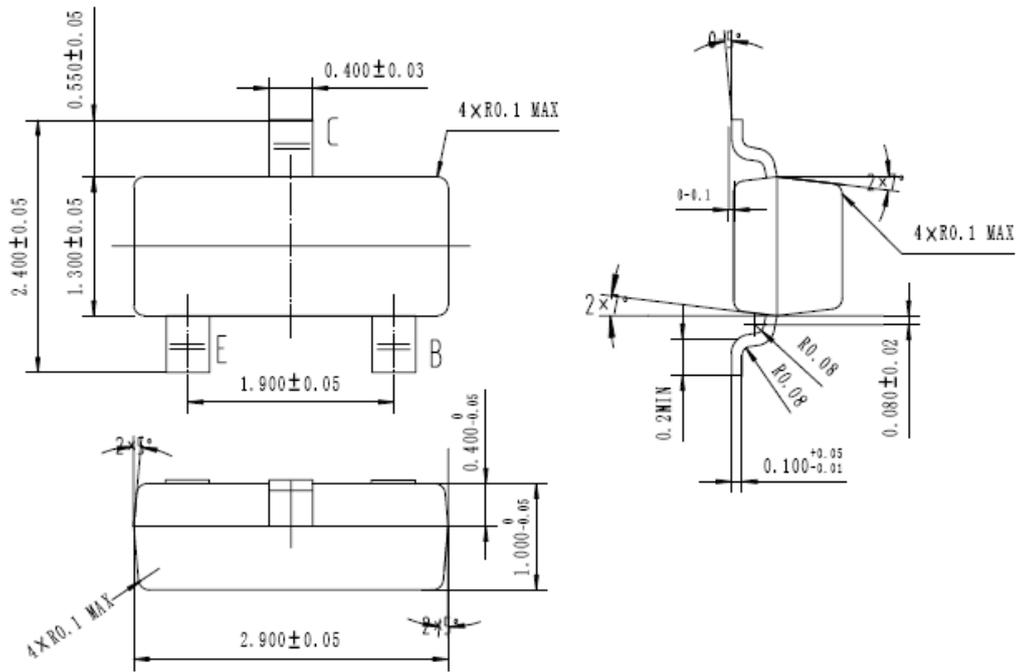
## 5) NCH driver output current vs. Input voltage

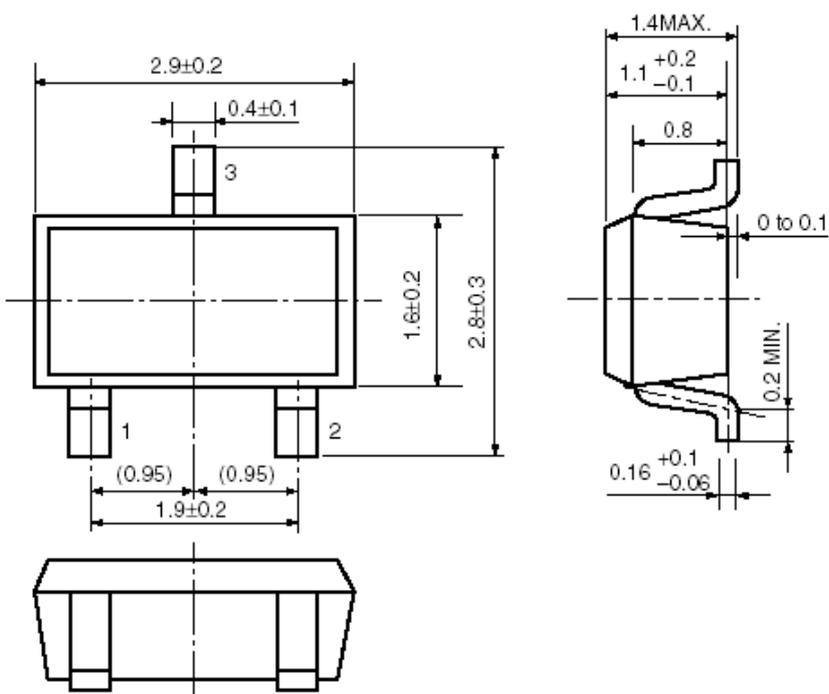


## 6) PCH driver output current vs. Input current

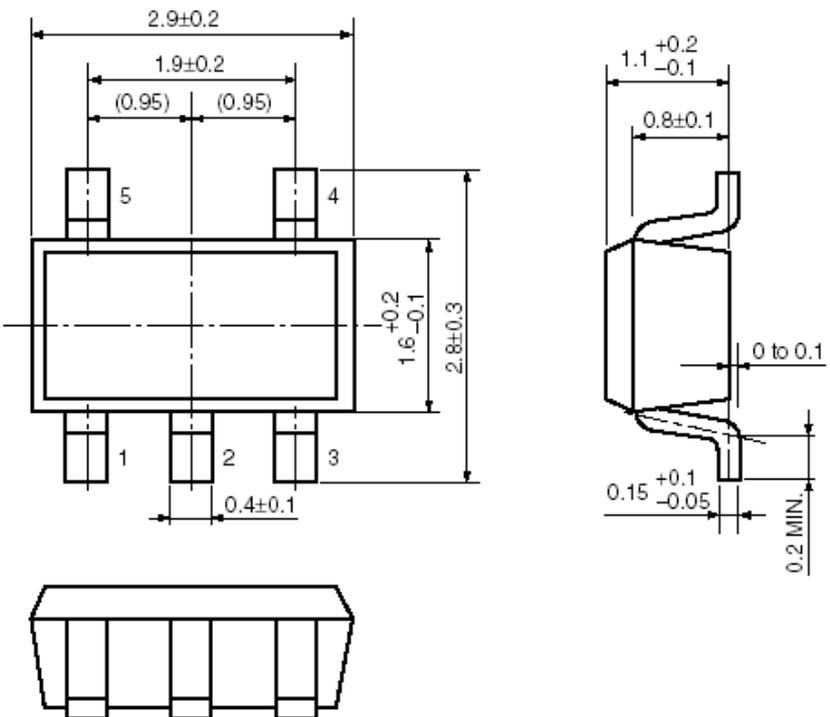


## PACKAGE OUTLINE

Package	SOT23	Devices per reel	3000pcs
<p>Package dimension:</p>  <p>Unit: mm</p>			

Package	SOT23-3	Devices per reel	3000pcs
<p>Package dimension:</p>  <p>Unit: mm</p>			

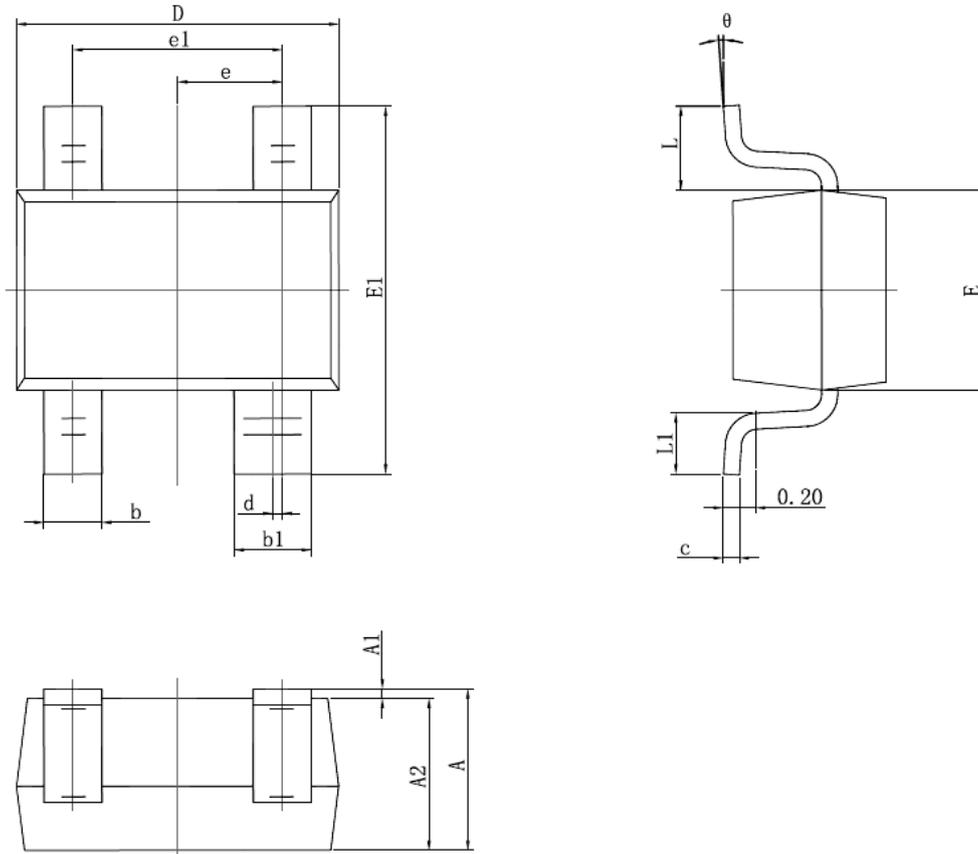
# BL8506

Package	SOT23-5	Devices per reel	3000pcs
<p data-bbox="165 371 384 400">Package dimension:</p>  <p data-bbox="165 1146 272 1173">Unit: mm</p> <p>The technical drawing illustrates the BL8506 package in three views. The top view shows a rectangular body with a total width of <math>2.9 \pm 0.2</math> mm and a central width of <math>1.9 \pm 0.2</math> mm. The distance between the two top leads (pins 5 and 4) is <math>1.9 \pm 0.2</math> mm, with each lead being <math>0.95</math> mm from the center. The distance between the three bottom leads (pins 1, 2, and 3) is <math>0.4 \pm 0.1</math> mm. The total height of the package is <math>2.8 \pm 0.3</math> mm, with a lead height of <math>1.6 \pm 0.1</math> mm. The side view shows a lead width of <math>1.1 \pm 0.2</math> mm, a lead thickness of <math>0.8 \pm 0.1</math> mm, and a lead length of <math>0.15 \pm 0.1</math> mm. The lead thickness is specified as <math>0.2</math> mm minimum. The lead angle is <math>0</math> to <math>0.1</math> degrees. The perspective view shows the package from an isometric angle.</p>			

# BL8506

Package	SC-82	Devices per reel	3000pcs
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Package dimension:



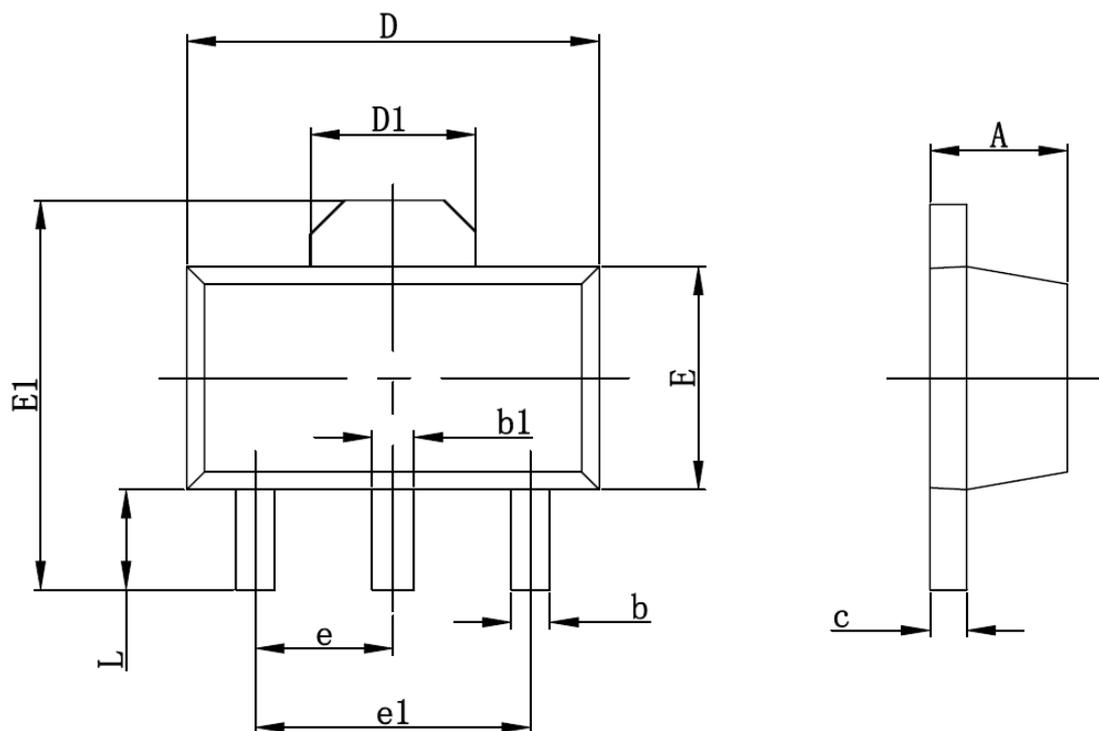
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.250	0.400	0.010	0.016
b1	0.350	0.500	0.014	0.020
c	0.080	0.150	0.003	0.006
d	0.050 TYP.		0.002 TYP.	
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650 TYP.		0.026 TYP.	
e1	1.200	1.400	0.047	0.055
L	0.525 REF.		0.021 REF.	
L1	0.260	0.460	0.010	0.018
$\theta$	0°	8°	0°	8°

Unit: mm

# BL8506

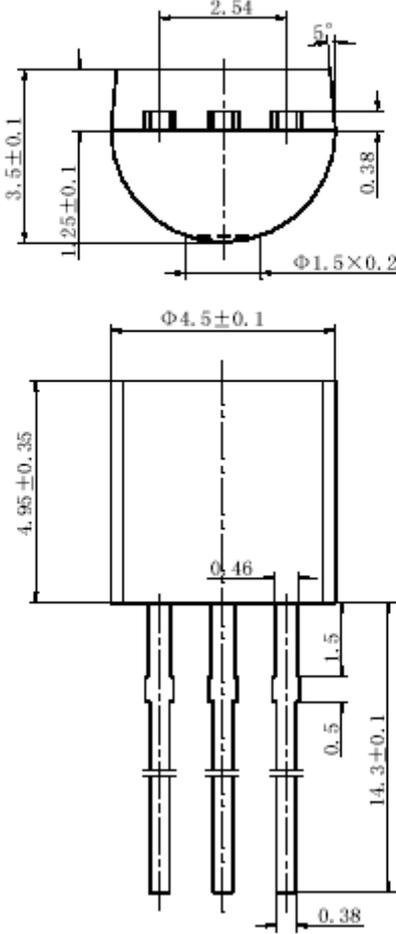
Package	SOT89-3	Devices per reel	1000pcs	Vendor	Wuxi Hongguang Microelectronics Co., Ltd.
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Package dimension:



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.350	0.520	0.013	0.197
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 REF		0.061 REF	
E	2.350	2.550	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP		0.060TYP	
e1	3.000 TYP		0.118TYP	
L	0.900	1.100	0.035	0.047

# BL8506

Package	TO-92	Devices per Bag	1000pcs
<p data-bbox="165 371 384 398">Package Dimension:</p> <p data-bbox="743 430 831 456" style="text-align: center;">TO-92</p>  <p>The technical drawing shows two views of a TO-92 package. The top view is a semi-circular shape with a diameter of <math>\Phi 1.5 \pm 0.2</math> mm. The overall width is <math>2.54</math> mm. The height from the top edge to the center of the semi-circle is <math>3.5 \pm 0.1</math> mm. The distance from the top edge to the bottom edge of the semi-circle is <math>1.25 \pm 0.1</math> mm. The thickness of the package is <math>0.38</math> mm. The side view shows a cylindrical body with a diameter of <math>\Phi 4.5 \pm 0.1</math> mm and a height of <math>4.95 \pm 0.35</math> mm. The distance from the top edge of the cylindrical body to the top edge of the leads is <math>0.46</math> mm. The leads are spaced <math>1.5</math> mm apart. The length of the leads is <math>14.3 \pm 0.1</math> mm. The diameter of the leads is <math>0.5</math> mm. The distance from the top edge of the leads to the bottom edge of the leads is <math>0.38</math> mm.</p> <p data-bbox="165 1529 268 1556">Unit: mm</p>			