

### Description

ACE302 is a series of high precision voltage detector with ultra low current consumption (500nA typ. at Vdd=3.0V) and a built-in delay circuit. It can work at very low voltage, which makes it perfect for system reset.

ACE302 is composed of high precision voltage reference, comparator, delay circuit, 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.

ACE302 is available in SOT-23-3 which is Pb free.

### Features

- High-precision detection Voltage :  $\pm 2\%$
- Detection Voltage : 0.9V~6.0V (in 0.1V steps)
- Built-in Power on Reset Delay Time circuit::Refer to Selection Guide
- Operating Voltage range : 0.7V~10V
- Ultra-low current consumption : 500nA typ. (at VDD=3.0V)
- Two Output forms : CMOS and N-channel open-drain (Active Low)

### Application

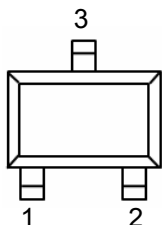
- Power monitor for portable equipment such as PDA,DSC,Mobile phone,Notebook,MP3
- CPU and Logic Circuit Reset
- Battery Checker
- Battery Back-up Circuit
- Power Failure Detector

### Absolute Maximum Ratings

| Parameter           | Symbol | Max     | Unit |
|---------------------|--------|---------|------|
| Input Voltage       |        | -0.3~12 | V    |
| Output Voltage      |        | -0.3~12 | V    |
| Output Current      |        | 70      | mA   |
| Power Dissipation   |        | 150     | mW   |
| Ambient temperature |        | -40~85  | °C   |
| Storage temperature |        | -40~125 | °C   |

### Packaging Type

SOT-23-3



| Pin No | Symbol    | Description                  |
|--------|-----------|------------------------------|
| 1      | $V_{SS}$  | GND Pin                      |
| 2      | $V_{OUT}$ | Voltage detection output pin |
| 3      | $V_{DD}$  | Voltage input Pin            |

### Ordering information

Selection Guide

ACE302 X XXX X XX + H

Halogen - free

Pb - free

Package type

BM: SOT-23-3

Delay time: A:50ms / B:100ms / C:150ms / D:200ms /  
E:250ms / F:300ms / G:400ms

Detector Voltage:

090...0.9V / 100...1.0V / 263...2.63V / 300...3.0V /  
465...4.65V.....600...6.0V (In 0.1V step)

Output type:

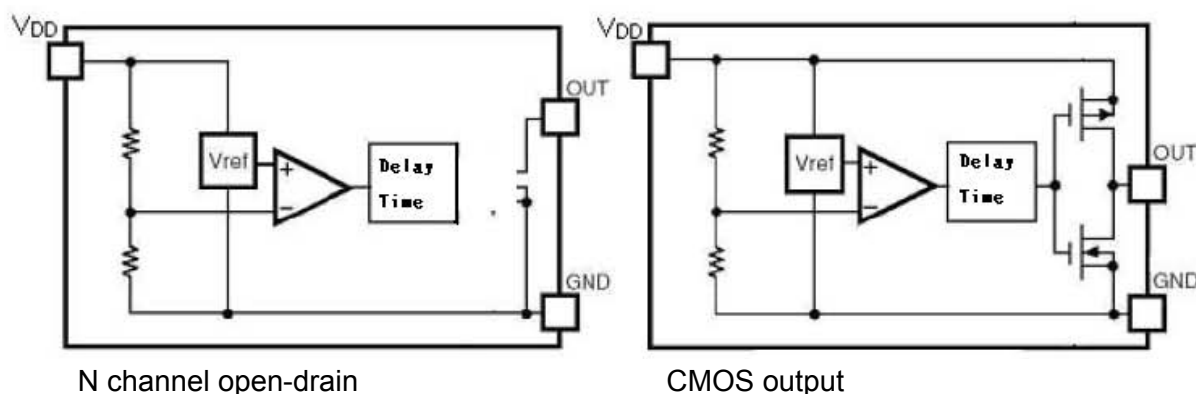
N: Nch

C: CMOS

### Recommended Work Conditions

| Item                          | Min | Typ. | Max | Unit |
|-------------------------------|-----|------|-----|------|
| Input Voltage ( $V_{in}$ )    | 0.7 |      | 10  | V    |
| Ambient Temperature ( $T_J$ ) | -40 | 25   | 85  | °C   |

### Block diagram



### Electrical Characteristics

ACE302N090DBM+ (0.9V) (T<sub>opt</sub>=25°C, Unless otherwise specified)

| Symbol            | Parameter                 | Conditions                                                                                            | Reference data |              |       | Unit |
|-------------------|---------------------------|-------------------------------------------------------------------------------------------------------|----------------|--------------|-------|------|
|                   |                           |                                                                                                       | Min.           | Typ.         | Max.  |      |
| -V <sub>DET</sub> | Detector Threshold        |                                                                                                       | 0.882          | 0.9          | 0.918 | V    |
| I <sub>SS</sub>   | Current consumption       | V <sub>DD</sub> =2.9V                                                                                 |                | 1            | 1.5   | μA   |
| 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<br>V <sub>DS</sub> =0.05V, V <sub>DD</sub> =0.7V<br>V <sub>DS</sub> =0.50V, V <sub>DD</sub> =0.8V | 0.01<br>0.05   | 0.05<br>0.50 |       | mA   |
|                   |                           | Pch<br>V <sub>DS</sub> =-2.1V, V <sub>DD</sub> =4.50V                                                 | 1.0            | 2.0          |       | mA   |

ACE302N270DBM+ (2.7V) (T<sub>opt</sub>=25°C, Unless otherwise specified)

| Symbol            | Parameter                 | Conditions                                            | Reference data |      |       | Unit |
|-------------------|---------------------------|-------------------------------------------------------|----------------|------|-------|------|
|                   |                           |                                                       | Min.           | Typ. | Max.  |      |
| -V <sub>DET</sub> | Detector Threshold        |                                                       | 2.646          | 2.7  | 2.754 | V    |
| I <sub>SS</sub>   | Current consumption       | V <sub>DD</sub> =4.7V                                 |                | 0.5  | 1     | μA   |
| 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<br>V <sub>DS</sub> =0.05V, V <sub>DD</sub> =0.7V  | 0.01           | 0.05 |       | mA   |
|                   |                           | Pch<br>V <sub>DS</sub> =-2.1V, V <sub>DD</sub> =4.50V | 1.0            | 2.0  |       | mA   |

ACE302N300DBM+ (3.0V) (T<sub>opt</sub>=25°C, Unless otherwise specified)

| Symbol            | Parameter                 | Conditions                                            | Reference data |      |      | Unit |
|-------------------|---------------------------|-------------------------------------------------------|----------------|------|------|------|
|                   |                           |                                                       | Min.           | Typ. | Max. |      |
| -V <sub>DET</sub> | Detector Threshold        |                                                       | 2.94           | 3.0  | 3.06 | V    |
| I <sub>SS</sub>   | Current consumption       | V <sub>DD</sub> =5.0V                                 |                | 0.5  | 1    | 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<br>V <sub>DS</sub> =0.05V, V <sub>DD</sub> =0.7V  | 0.01           | 0.05 |      | mA   |
|                   |                           | Pch<br>V <sub>DS</sub> =-2.1V, V <sub>DD</sub> =4.50V | 1.0            | 2.0  |      | mA   |

ACE302N340DBM+ (3.4V) (T<sub>opt</sub>=25°C, Unless otherwise specified)

| Symbol            | Parameter                 | Conditions                                            | Reference data |      |       | Unit |
|-------------------|---------------------------|-------------------------------------------------------|----------------|------|-------|------|
|                   |                           |                                                       | Min.           | Typ. | Max.  |      |
| -V <sub>DET</sub> | Detector Threshold        |                                                       | 3.332          | 3.4  | 3.468 | V    |
| I <sub>SS</sub>   | Current consumption       | V <sub>DD</sub> =5.0V                                 |                | 0.5  | 1     | 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<br>V <sub>DS</sub> =0.05V, V <sub>DD</sub> =0.7V  | 0.01           | 0.05 |       | mA   |
|                   |                           | Pch<br>V <sub>DS</sub> =-2.1V, V <sub>DD</sub> =4.50V | 1.0            | 2.0  |       | mA   |

ACE302N440DBM+ (4.4V) (T<sub>opt</sub>=25°C, Unless otherwise specified)

| Symbol            | Parameter                 | Conditions                                           | Reference data |      |       | Unit |
|-------------------|---------------------------|------------------------------------------------------|----------------|------|-------|------|
|                   |                           |                                                      | Min.           | Typ. | Max.  |      |
| -V <sub>DET</sub> | Detector Threshold        |                                                      | 4.312          | 4.4  | 4.488 | V    |
| I <sub>SS</sub>   | Current consumption       | V <sub>DD</sub> =6.4V                                |                | 0.5  | 1     | 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<br>V <sub>DS</sub> =0.05V, V <sub>DD</sub> =0.7V | 0.01           | 0.05 |       | mA   |
|                   |                           | Pch<br>V <sub>DS</sub> =-2.1V, V <sub>DD</sub> =8.0V | 1.5            | 3.0  |       | mA   |

### Electrical Characteristics By Detector Threshold

| Part Number    | Detector Threshold |       |       | Supply Current1          |     |     | Supply Current2        |     |     |
|----------------|--------------------|-------|-------|--------------------------|-----|-----|------------------------|-----|-----|
|                | -Vdet[V]           |       |       | Iss1[uA]                 |     |     | Iss2[uA]               |     |     |
|                | Min                | Typ   | Max   | Condition                | Typ | Max | Condition              | Typ | Max |
| ACE302X090XXX+ | 0.882              | 0.900 | 0.918 | Vdd=<br>(-Vdet)<br>+0.1V | 0.5 | 1.0 | Vdd=<br>(-Vdet)<br>+2V | 1.0 | 1.5 |
| ACE302X100XXX+ | 0.980              | 1.000 | 1.020 |                          |     |     |                        |     |     |
| ACE302X110XXX+ | 1.078              | 1.100 | 1.122 |                          |     |     |                        |     |     |
| ACE302X120XXX+ | 1.176              | 1.200 | 1.224 |                          |     |     |                        |     |     |
| ACE302X130XXX+ | 1.274              | 1.300 | 1.326 |                          |     |     |                        |     |     |
| ACE302X140XXX+ | 1.372              | 1.400 | 1.428 |                          |     |     |                        |     |     |
| ACE302X150XXX+ | 1.470              | 1.500 | 1.530 |                          |     |     |                        |     |     |
| ACE302X160XXX+ | 1.568              | 1.600 | 1.632 |                          |     |     |                        |     |     |
| ACE302X170XXX+ | 1.666              | 1.700 | 1.734 |                          |     |     |                        |     |     |
| ACE302X180XXX+ | 1.764              | 1.800 | 1.836 |                          |     |     |                        |     |     |
| ACE302X190XXX+ | 1.862              | 1.900 | 1.938 |                          |     |     |                        |     |     |
| ACE302X200XXX+ | 1.960              | 2.000 | 2.040 |                          |     |     |                        | 0.5 | 1.0 |
| ACE302X210XXX+ | 2.058              | 2.100 | 2.142 |                          |     |     |                        |     |     |
| ACE302X220XXX+ | 2.156              | 2.200 | 2.244 |                          |     |     |                        |     |     |
| ACE302X230XXX+ | 2.254              | 2.300 | 2.346 |                          |     |     |                        |     |     |
| ACE302X240XXX+ | 2.352              | 2.400 | 2.448 |                          |     |     |                        |     |     |
| ACE302X250XXX+ | 2.450              | 2.500 | 2.550 |                          |     |     |                        |     |     |
| ACE302X260XXX+ | 2.548              | 2.600 | 2.652 |                          |     |     |                        |     |     |
| ACE302X270XXX+ | 2.646              | 2.700 | 2.754 |                          |     |     |                        |     |     |
| ACE302X280XXX+ | 2.744              | 2.800 | 2.856 |                          |     |     |                        |     |     |
| ACE302X290XXX+ | 2.842              | 2.900 | 2.958 |                          |     |     |                        |     |     |
| ACE302X300XXX+ | 2.940              | 3.000 | 3.060 |                          |     |     |                        |     |     |
| ACE302X310XXX+ | 3.038              | 3.100 | 3.162 |                          |     |     |                        |     |     |
| ACE302X320XXX+ | 3.136              | 3.200 | 3.264 |                          |     |     |                        |     |     |
| ACE302X330XXX+ | 3.234              | 3.300 | 3.366 |                          |     |     |                        |     |     |
| ACE302X340XXX+ | 3.332              | 3.400 | 3.468 |                          |     |     |                        |     |     |
| ACE302X350XXX+ | 3.430              | 3.500 | 3.570 |                          |     |     |                        |     |     |
| ACE302X360XXX+ | 3.528              | 3.600 | 3.672 |                          |     |     |                        |     |     |
| ACE302X370XXX+ | 3.626              | 3.700 | 3.774 |                          |     |     |                        |     |     |
| ACE302X380XXX+ | 3.724              | 3.800 | 3.876 |                          |     |     |                        |     |     |
| ACE302X390XXX+ | 3.822              | 3.900 | 3.978 |                          |     |     |                        |     |     |
| ACE302X400XXX+ | 3.920              | 4.000 | 4.080 |                          |     |     |                        |     |     |
| ACE302X410XXX+ | 4.018              | 4.100 | 4.182 |                          |     |     |                        |     |     |
| ACE302X420XXX+ | 4.116              | 4.200 | 4.284 |                          |     |     |                        |     |     |

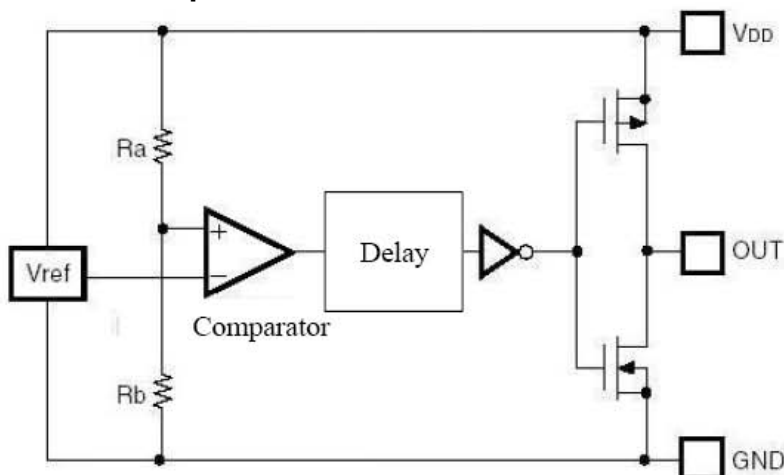
|                |       |       |       |  |  |  |  |  |  |
|----------------|-------|-------|-------|--|--|--|--|--|--|
| ACE302X430XXX+ | 4.214 | 4.300 | 4.386 |  |  |  |  |  |  |
| ACE302X440XXX+ | 4.312 | 4.400 | 4.488 |  |  |  |  |  |  |
| ACE302X450XXX+ | 4.410 | 4.500 | 4.590 |  |  |  |  |  |  |
| ACE302X460XXX+ | 4.508 | 4.600 | 4.692 |  |  |  |  |  |  |
| ACE302X470XXX+ | 4.606 | 4.700 | 4.794 |  |  |  |  |  |  |
| ACE302X480XXX+ | 4.704 | 4.800 | 4.896 |  |  |  |  |  |  |
| ACE302X490XXX+ | 4.802 | 4.900 | 4.998 |  |  |  |  |  |  |
| ACE302X500XXX+ | 4.900 | 5.000 | 5.100 |  |  |  |  |  |  |
| ACE302X510XXX+ | 4.998 | 5.100 | 5.202 |  |  |  |  |  |  |
| ACE302X520XXX+ | 5.096 | 5.200 | 5.304 |  |  |  |  |  |  |
| ACE302X530XXX+ | 5.194 | 5.300 | 5.406 |  |  |  |  |  |  |
| ACE302X540XXX+ | 5.292 | 5.400 | 5.508 |  |  |  |  |  |  |
| ACE302X550XXX+ | 5.390 | 5.500 | 5.610 |  |  |  |  |  |  |
| ACE302X560XXX+ | 5.488 | 5.600 | 5.712 |  |  |  |  |  |  |
| ACE302X570XXX+ | 5.586 | 5.700 | 5.814 |  |  |  |  |  |  |
| ACE302X580XXX+ | 5.684 | 5.800 | 5.916 |  |  |  |  |  |  |
| ACE302X590XXX+ | 5.782 | 5.900 | 6.018 |  |  |  |  |  |  |
| ACE302X600XXX+ | 5.880 | 6.000 | 6.120 |  |  |  |  |  |  |

| Output Current1             |      |      | Output Current2 |           |      |      | Minimum Operating Voltage |      | Detector Threshold Temperature Coefficient |      |
|-----------------------------|------|------|-----------------|-----------|------|------|---------------------------|------|--------------------------------------------|------|
| Iout1[mA]                   |      |      | Iout2[mA]       |           |      |      | VDDL[V]                   |      | -VDET/ Tppm/°C                             |      |
| Condition                   | Min. | Typ. | Condition       |           | Min. | Typ. | Typ.                      | Max. | Condition                                  | Typ. |
| NCH,<br>VDS=0.05V, VDD=0.7V | 0.01 | 0.05 | NCH, VDS=0.5V   | VDD=0.85V | 0.1  | 0.5  | 0.5                       | 0.7  | -40°C Topt 85°C                            | 100  |
|                             |      |      |                 | VDD=1.0V  | 0.2  | 1.0  |                           |      |                                            |      |
|                             |      |      |                 | VDD=1.5V  | 1.0  | 2.0  |                           |      |                                            |      |

### Electrical Characteristics By Output Delay Time

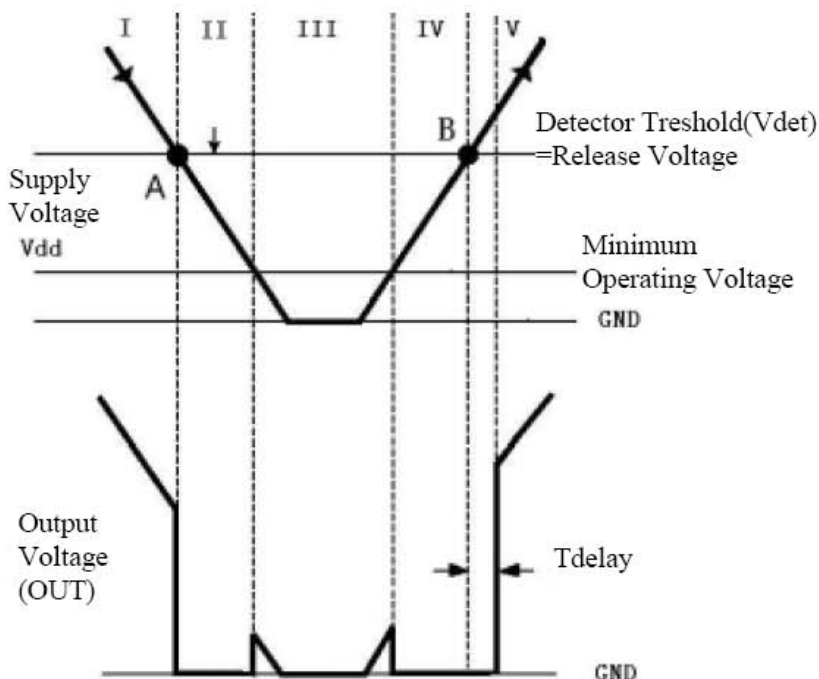
| Part Number    | Test Condition        | Output Delay Time |     |     | Unit |
|----------------|-----------------------|-------------------|-----|-----|------|
|                |                       | Min               | Typ | Max |      |
| ACE302XXXXAXX+ | VDD=1.0V to Vdet+1.0V | 45                | 50  | 55  | ms   |
| ACE302XXXXBXX+ |                       | 90                | 100 | 110 |      |
| ACE302XXXXCXX+ |                       | 135               | 150 | 165 |      |
| ACE302XXXXDXX+ |                       | 180               | 200 | 220 |      |
| ACE302XXXXEXX+ |                       | 225               | 250 | 275 |      |
| ACE302XXXXFXX+ |                       | 270               | 300 | 330 |      |
| ACE302XXXXGXX+ |                       | 360               | 400 | 440 |      |

#### 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 and Rb, is applied to the positive input of the comparator. Output of the comparator passes a delay circuit and a series of buffer to drive the output CMOS pair.

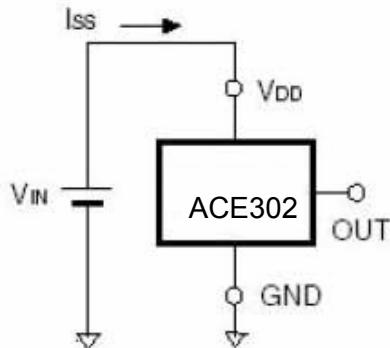
$$V_{DET} = V_{REF} * (1 + R_a/R_b)$$



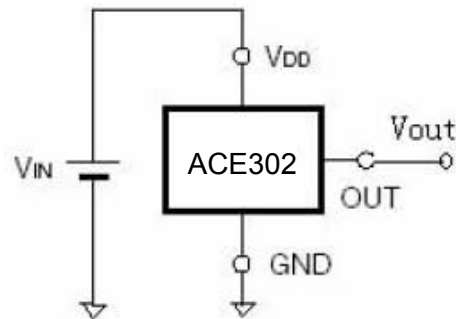
| No  | Operation status                       | Output status                                             |
|-----|----------------------------------------|-----------------------------------------------------------|
| I   | $V_{DD} > V_{det}$                     | Output voltage is equal to the supply 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 after $T_{delay}$ |

#### Typical Circuits

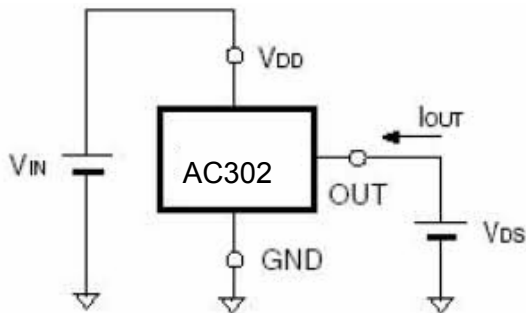
(1) Supply current test circuit



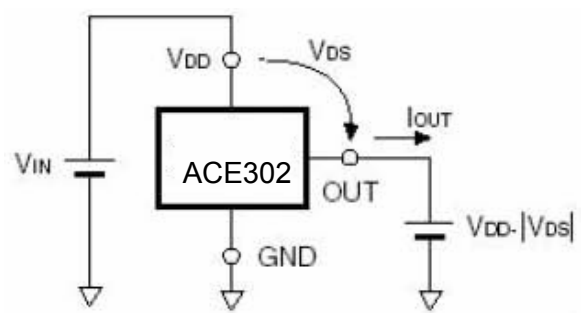
(2) Detector threshold test circuit



(3) NCHply current test circuit



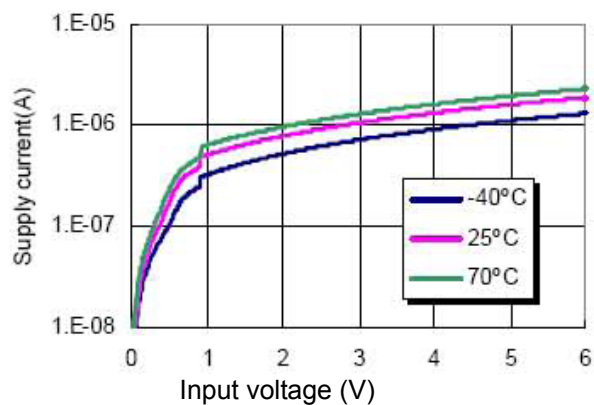
(2) Detector threshold test circuit



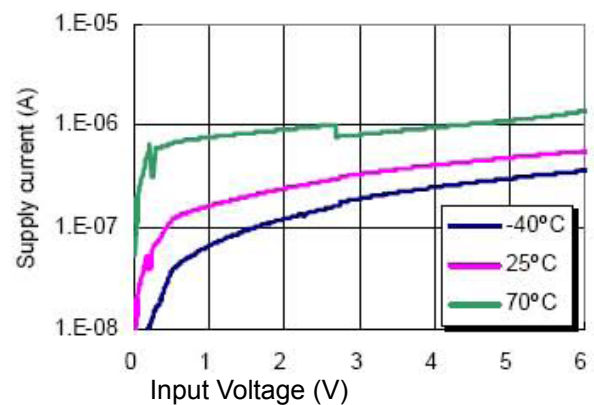
#### Typical Performance Characteristics

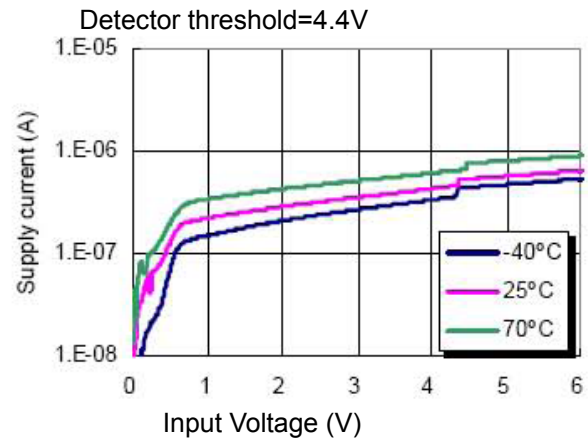
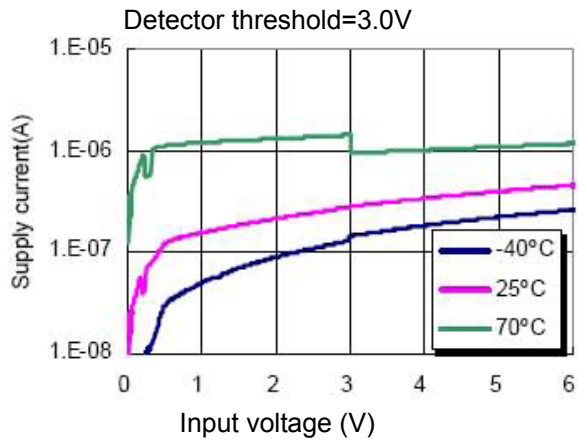
1. Supply current VS. Input Voltage

Detector threshold=0.9V

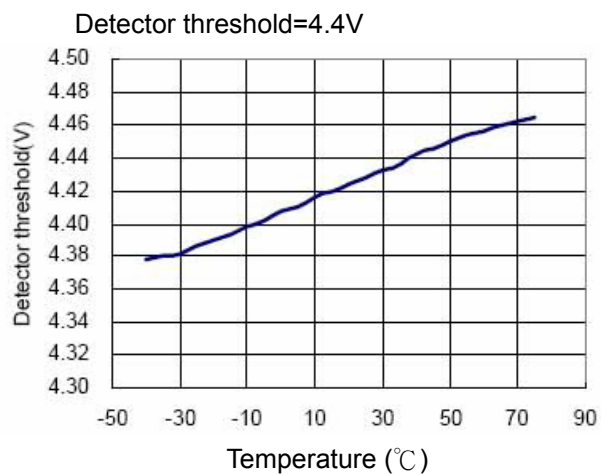
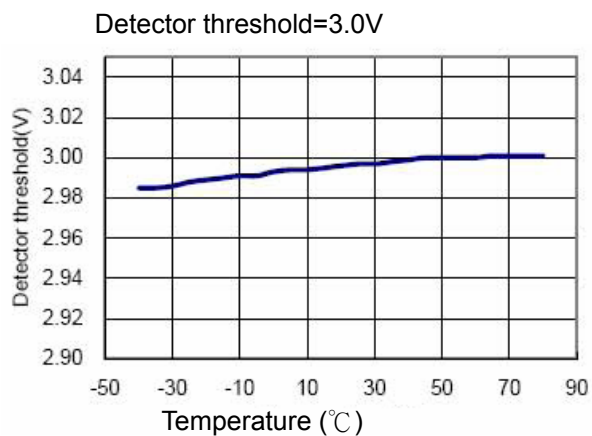
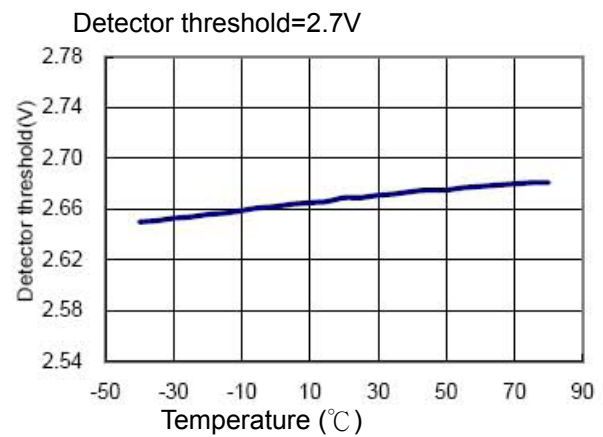
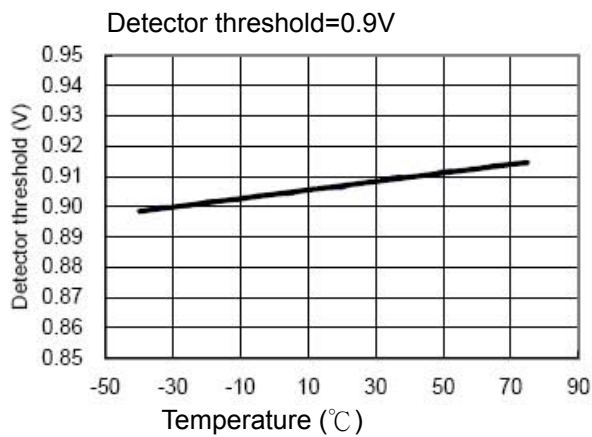


Detector threshold=2.7V



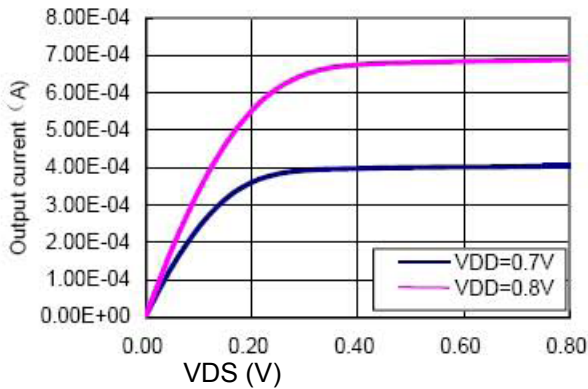


## 2. Detector Threshold VS. Temperature

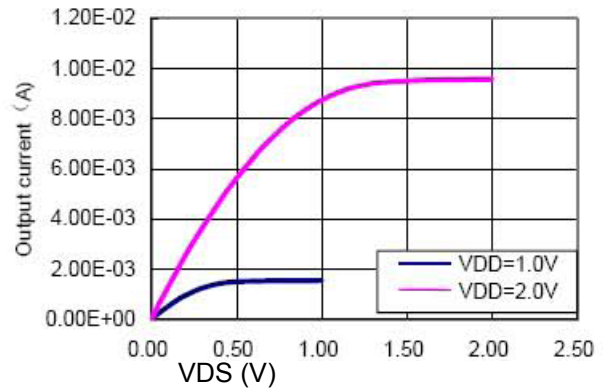


### 3. Nch Driver Output Current VS. V<sub>DS</sub>

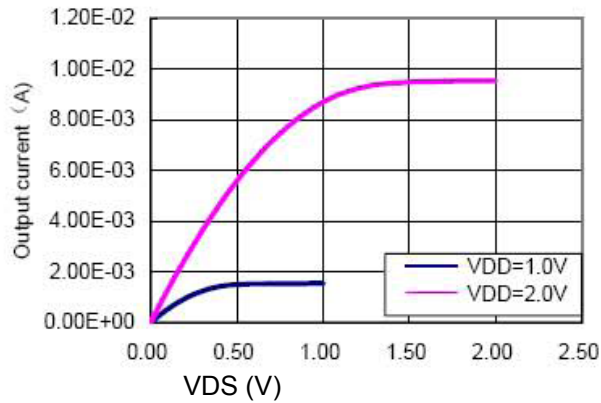
ACE302X090XXX+



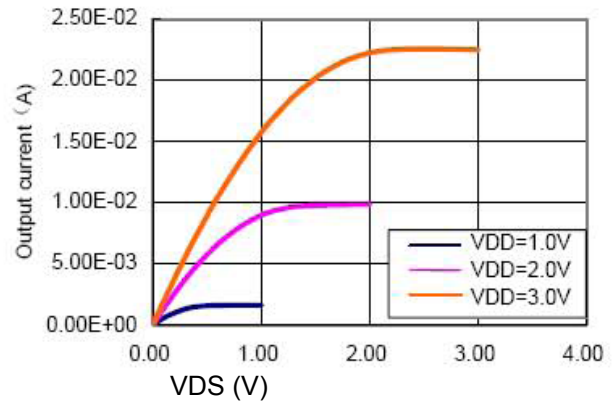
ACE302X270XXX+



ACE302X300XXX+

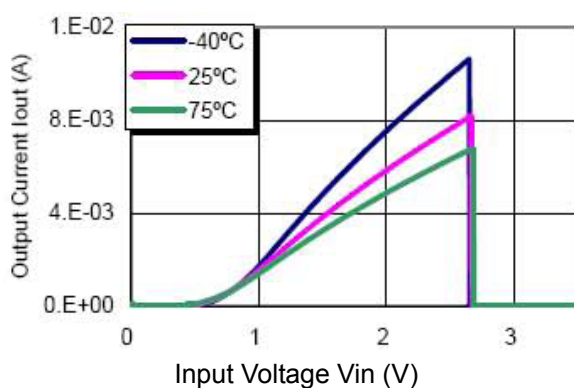


ACE302X440XXX+

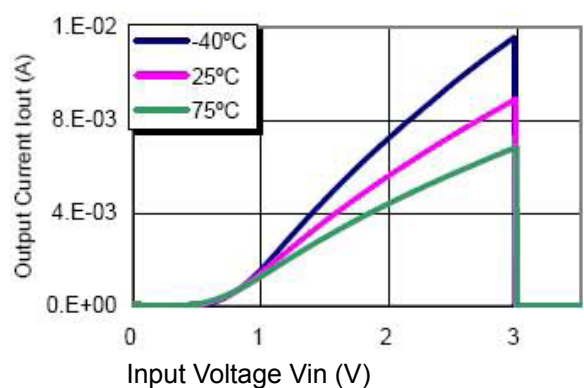


### 4. Nch Driver Output Current VS. Input Voltage

Detector threshold=2.7V

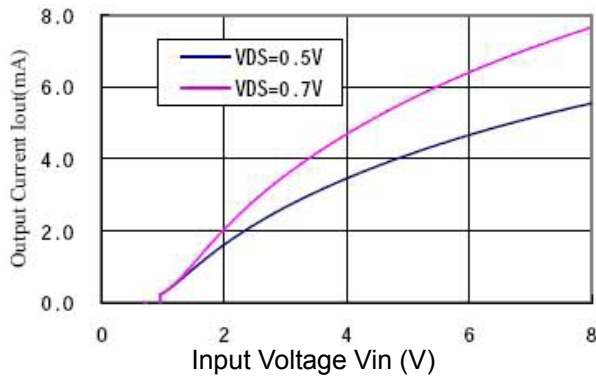


Detector threshold=3.0V

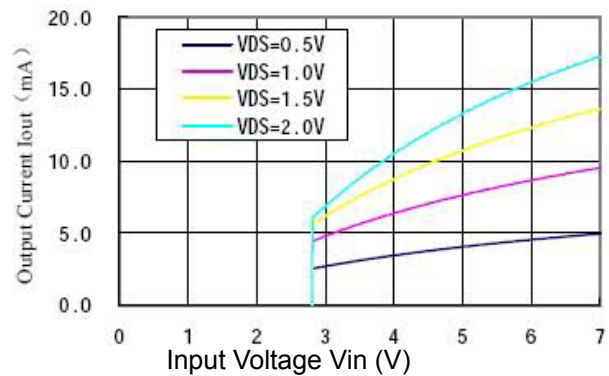


#### 5. PCH Driver Output Current VS. Input Current

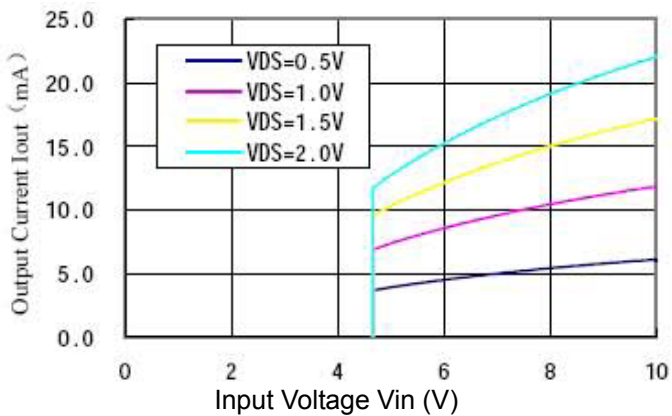
Detector threshold=0.9V



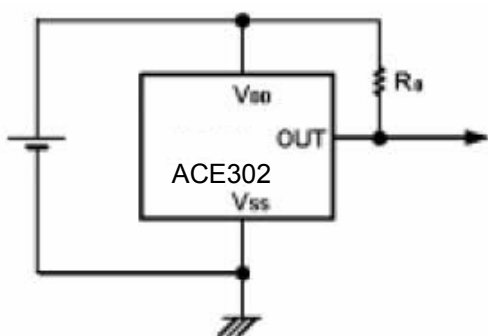
Detector threshold=2.7V



Detector threshold=4.4V



#### Typical Applications

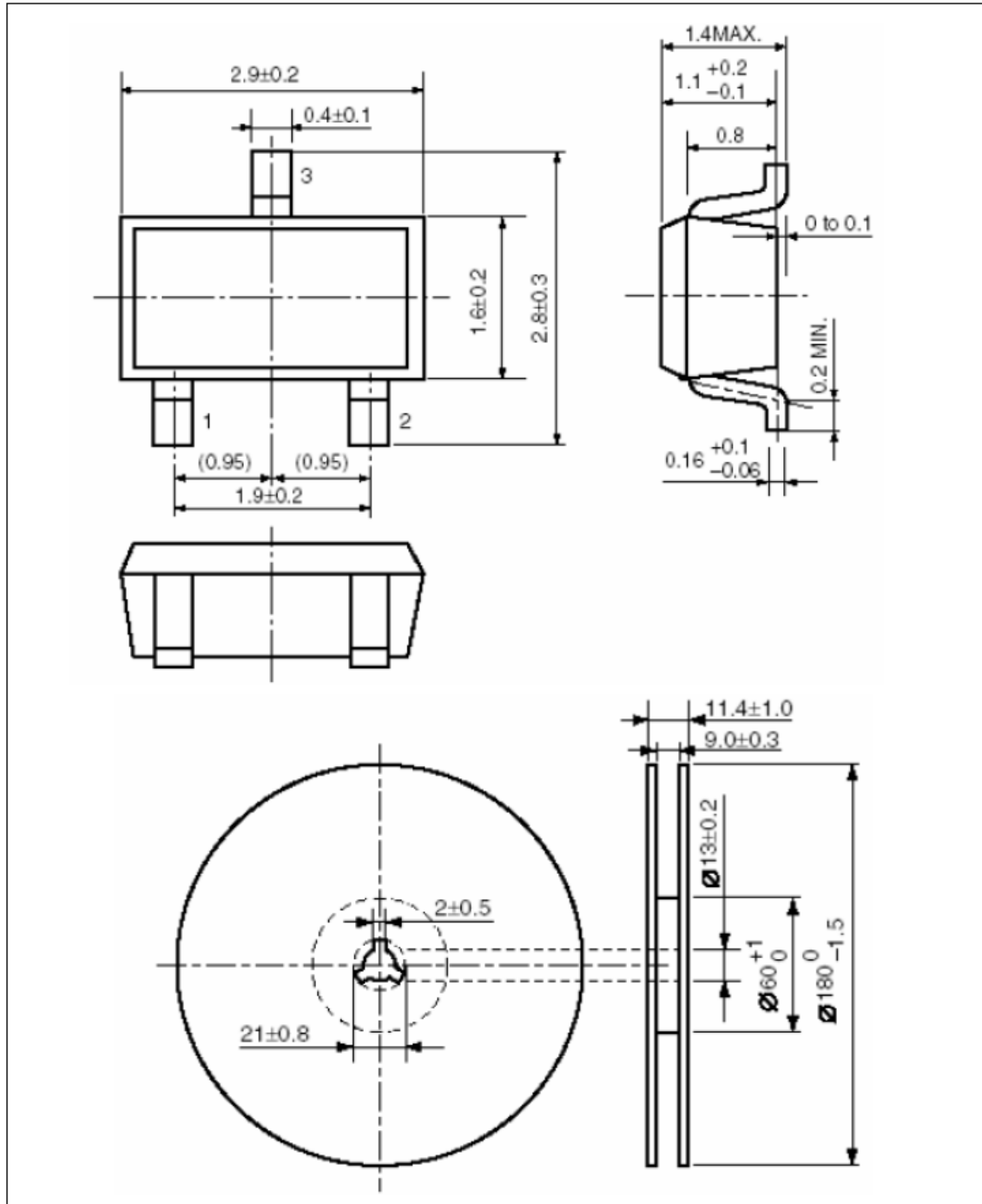


Note:

1. R0 is unnecessary for CMOS output products.
2. The value of R0 need to be selected in different application, Typical value is 470kΩ

### Packing Information

#### SOT-23-3



## Notes

ACE does not assume any responsibility for use as critical components in life support devices or systems without the express written approval of the president and general counsel of ACE Electronics Co., LTD. As sued herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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