



***Analog Semiconductor IC***

# VDA Series

Low voltage, Low power,  $\pm 1\%$  High detect accuracy  
CMOS Voltage Detector

**(IMPORTANT: Please check the last page for Genuine Product Labeling)**

Rev. E13-01

Website: [www.anasemi.com](http://www.anasemi.com)  
Tel: +852-3590-8442  
Email: [sales@anasemi.com](mailto:sales@anasemi.com)

**AnaSem**  
..... Future of the analog world



# AnaSem

## Products Data Sheet

### Analog Semiconductor IC

Low voltage, Low power,  $\pm 1\%$  High detect accuracy CMOS Voltage Detector

## VDA Series

### GENERAL DESCRIPTIONS

The VDA series are voltage detectors with low voltage, low power consumption and high accuracy. The accuracy of the detection voltage is detected based on a voltage reference of high accuracy that the temperature coefficient is controlled. The detection voltage is made in high accuracy by using the laser trimming technology.



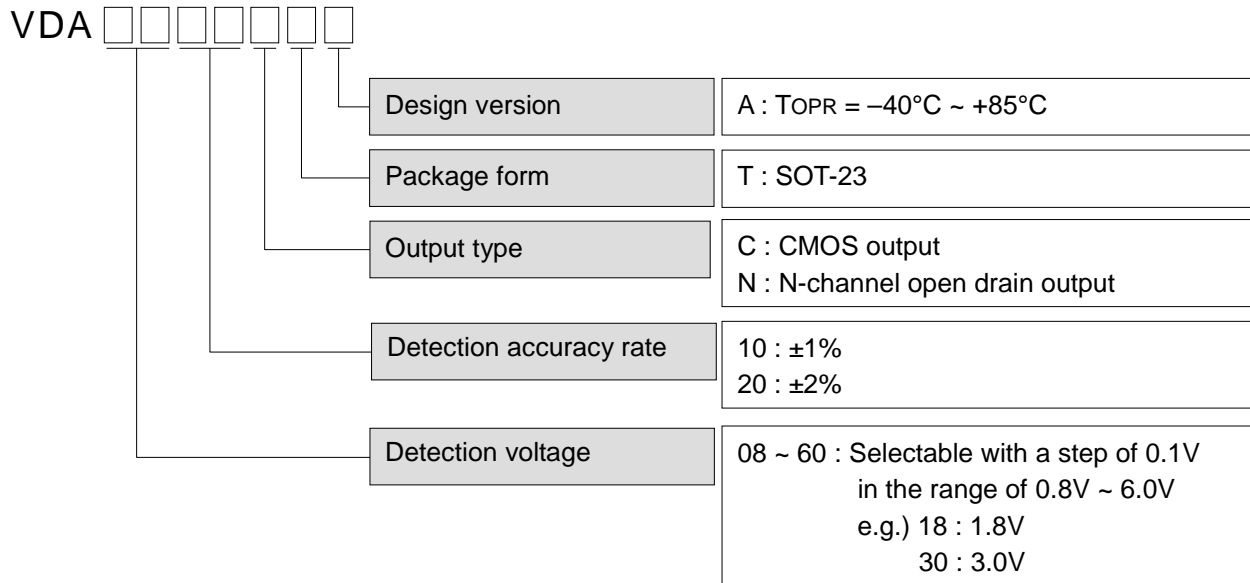
### FEATURES

- Detection voltage range ..... 0.8V~6.0V (selectable with a step of 0.1V)
- Operating voltage range ..... 0.7V~6.0V
- High accuracy detection voltage .....  $\pm 1\%$  ( $V_{DET}=1.8V\sim 6.0V$ ) /  $\pm 2\%$  ( $V_{DET}=0.8V\sim 1.7V$ )
- Detection voltage temperature characteristics ..... Typ.  $\pm 20\text{ppm}/^\circ\text{C}$  ( $V_{DET} = 1.8V\sim 6.0V$ )
- Output types ..... CMOS or N-channel open drain
- Low current consumption ..... Typ.  $0.6\mu\text{A}$  ( $V_{IN} = 1.5V$ )
- Operating temperature range .....  $-40^\circ\text{C} \sim +85^\circ\text{C}$
- Small package ..... SOT-23 (2.9x2.8x1.1mm)

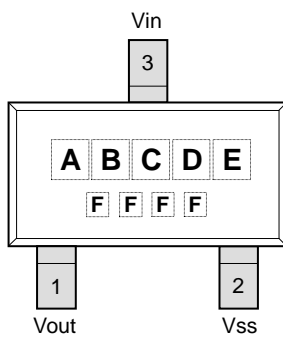
### APPLICATIONS

- Reset of microprocessor
- Power-on reset of system
- Charge detection of battery
- Battery back-up of memory
- Monitoring of battery life time

**PRODUCTS NUMBERING GUIDE**



**PIN CONFIGURATION / MARKING SPECIFICATION (SOT-23)**



(Top view)

● **Pin Configuration**

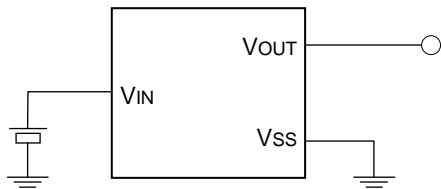
| No. | Symbol | Descriptions  |
|-----|--------|---------------|
| 1   | VOUT   | Output        |
| 2   | VSS    | Power ground  |
| 3   | VIN    | Voltage input |

● **Marking Specification**

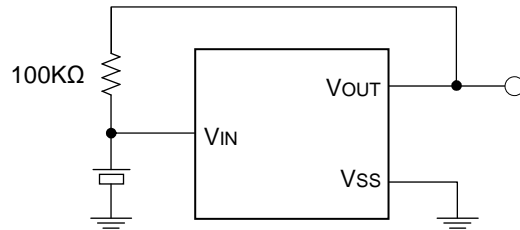
| Code | Mark          | Contents                |
|------|---------------|-------------------------|
| A    | C or N        | Output type             |
| BC   | 08~60         | Detection voltage       |
| D    | 1 or 2        | Detection accuracy rate |
| E    | A             | Version                 |
| F    | Internal rule | Lot number              |

## TYPICAL APPLICATION CIRCUITS

- CMOS output

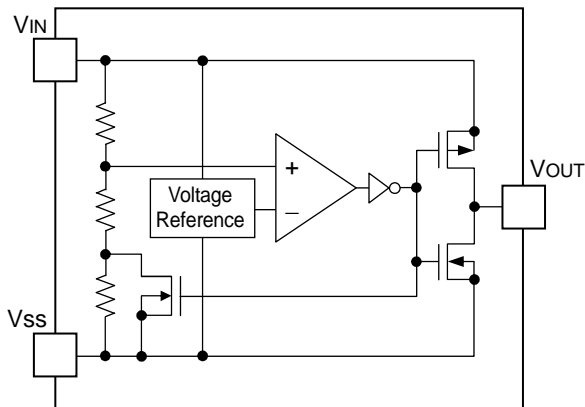


- N-channel open drain output

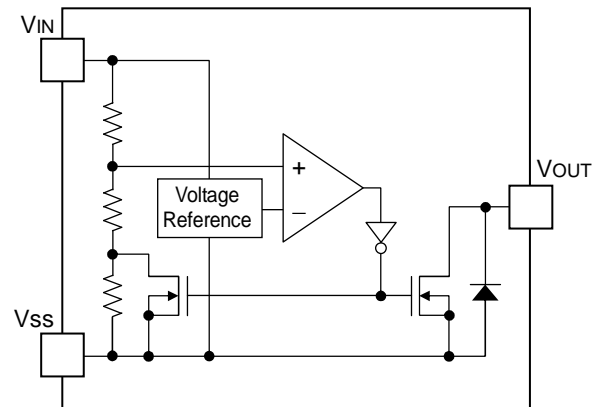


## BLOCK DIAGRAM

- CMOS output



- N-channel open drain output



## ABSOLUTE MAXIMUM RATINGS

| Items                          | Symbol           | Ratings                                     | Unit |
|--------------------------------|------------------|---|------|
| Input voltage range            | V <sub>IN</sub>  | -0.3 ~ +7.0                                 | V    |
| Output current                 | I <sub>OUT</sub> | 50  | mA   |
| Output voltage range           | V <sub>OUT</sub> | V <sub>SS</sub> -0.3 ~ V <sub>IN</sub> +0.3 | V    |
| Power dissipation ※1)   SOT-23 | P <sub>D</sub>   | 400   | mW   |
| Operating temperature range    | T <sub>OPR</sub> | -40 ~ +85                                   | °C   |
| Storage temperature range      | T <sub>STG</sub> | -55 ~ +125                                  | °C   |

Note :

※1) Power dissipation depends on conditions of mounting on boards.  
PCB dimension is 50mm×50mm×1.6mm.

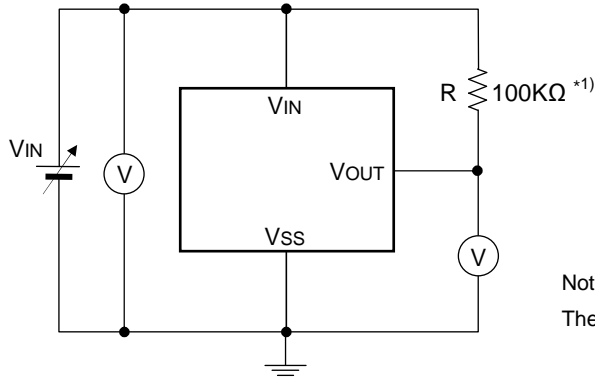
**ELECTRICAL CHARACTERISTICS**

(Ta=25°C unless otherwise specified)

| Items   | Symbol                                   | Conditions   | Min.                      | Typ.                      | Max.                      | Unit   | Test circuit |   |
|---|--|--|---------------------------|---------------------------|---------------------------|--------|--------------|---|
| Operating voltage   | V <sub>IN</sub>                          | V <sub>DET</sub> = 0.8V ~ 6.0V                       | 0.7                       | -                         | 6.0                       | V      | 1            |   |
| Detection voltage   | V <sub>DET</sub>                         | V <sub>DET</sub> = 1.8V ~ 6.0V<br>Ta = -40°C ~ +85°C | V <sub>DET</sub><br>×0.99 | V <sub>DET</sub>          | V <sub>DET</sub><br>×1.01 | V      | 1            |   |
|   | V <sub>DET</sub>                         | V <sub>DET</sub> = 0.8V ~ 1.7V<br>Ta = -40°C ~ +85°C | V <sub>DET</sub><br>×0.98 | V <sub>DET</sub>          | V <sub>DET</sub><br>×1.02 | V      |              |   |
| Hysteresis range  | V <sub>HYS</sub>                         |  | V <sub>DET</sub><br>×0.02 | V <sub>DET</sub><br>×0.05 | V <sub>DET</sub><br>×0.08 | V      | 1            |   |
| Output current  | I <sub>OUT</sub>                         | N-ch<br>V <sub>DS</sub> =0.5V                        | V <sub>IN</sub> =0.7V     | 0.1                       | 0.35                      | -      | mA           | 3 |
|   |  |  | V <sub>IN</sub> =1.0V     | 1.0                       | 2.3                       | -      | mA           |   |
|   |  |  | V <sub>IN</sub> =2.0V     | 3.0                       | 8.2                       | -      | mA           |   |
|   |  |  | V <sub>IN</sub> =3.0V     | 5.0                       | 11.1                      | -      | mA           |   |
|   |  |  | V <sub>IN</sub> =4.0V     | 6.0                       | 12.8                      | -      | mA           |   |
|   |  |  | V <sub>IN</sub> =5.0V     | 7.0                       | 13.8                      | -      | mA           |   |
|   | CMOS P-ch<br>V <sub>DS</sub> =2.1V       | V <sub>IN</sub> =6.0V                                | -                         | -9.5                      | -1.5                      | mA     | 4            |   |
| CMOS N-ch<br>V <sub>DS</sub> =2.1V                        | V <sub>IN</sub> =6.0V                    | 1.5  | 9.5                       | -                         | mA                        | 3      |              |   |
| Current consumption                                       | I <sub>SS</sub>                          |  | V <sub>IN</sub> =1.5V     | -                         | 0.6                       | 2.1    | μA           | 2 |
|   |  |  | V <sub>IN</sub> =2.0V     | -                         | 0.7                       | 2.5    | μA           |   |
|   |  |  | V <sub>IN</sub> =3.0V     | -                         | 0.8                       | 2.8    | μA           |   |
|   |  |  | V <sub>IN</sub> =4.0V     | -                         | 0.9                       | 3.0    | μA           |   |
|   |  |  | V <sub>IN</sub> =5.0V     | -                         | 1.0                       | 3.4    | μA           |   |
| Leak current  | I <sub>LEAK</sub>                        | V <sub>IN</sub> =6.0V V <sub>OUT</sub> =6.0V         | -                         | 10                        | 100                       | nA     | 3            |   |
| Detection voltage temperature coefficient                 | ΔV <sub>DET</sub> / ΔTa·V <sub>DET</sub> | V <sub>DET</sub> = 1.8V ~ 6.0V<br>Ta = -40°C ~ +85°C | -                         | ±20                       | -                         | ppm/°C | 1            |   |
|   |  | V <sub>DET</sub> = 0.8V ~ 1.7V<br>Ta = -40°C ~ +85°C | -                         | ±100                      | -                         | ppm/°C |              |   |
| Delay time<br>V <sub>DR</sub> →V <sub>OUT</sub> inversion | T <sub>DLY</sub>                         | Inverts from V <sub>DR</sub> to V <sub>OUT</sub>     | -                         | 0.03                      | 0.2                       | ms     | 5            |   |

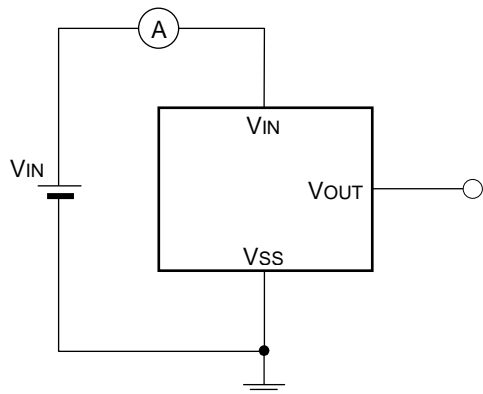
**TEST CIRCUITS**

- **Circuit (1)** – Operating voltage, Detection voltage, Hysteresis range, Detection voltage temperature coefficient

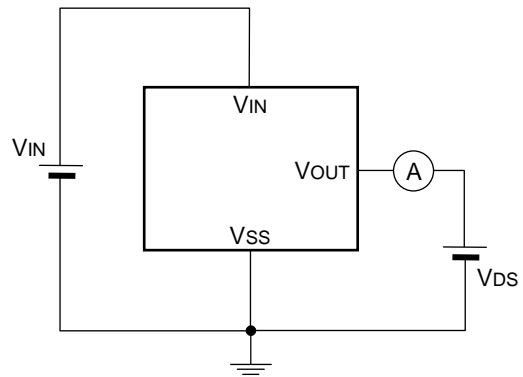


Note 1) :  
The resistor (100kΩ) is not necessary for CMOS output products.

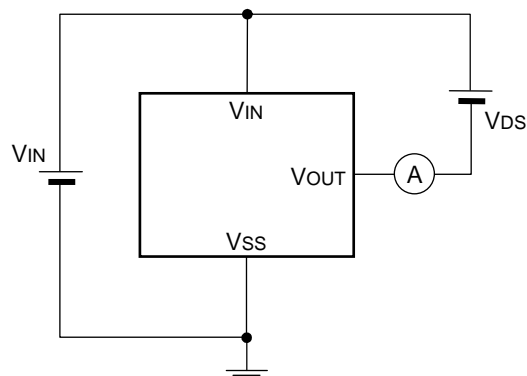
- **Circuit (2)** – Current consumption



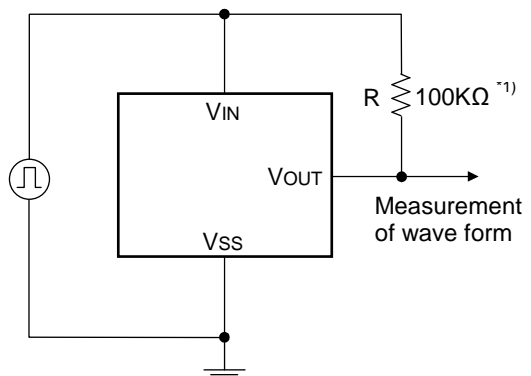
- **Circuit (3)** – N-ch driver output current



- **Circuit (4)** – P-ch driver output current



- **Circuit (5)** – Delay time (VDR→VOUT inversion)

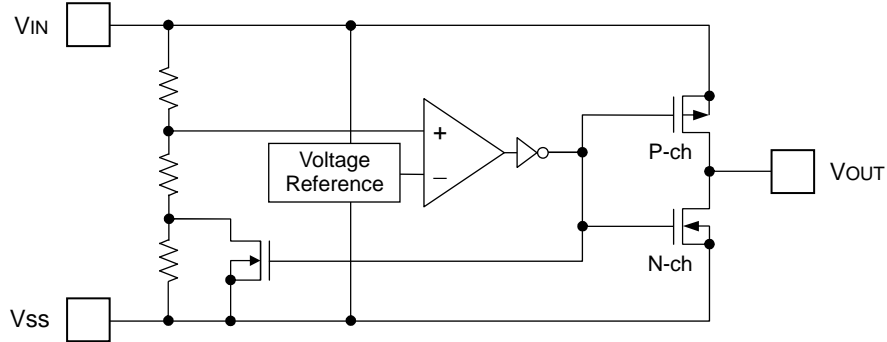


Note 1) :  
The resistor (100kΩ) is not necessary for CMOS output products.

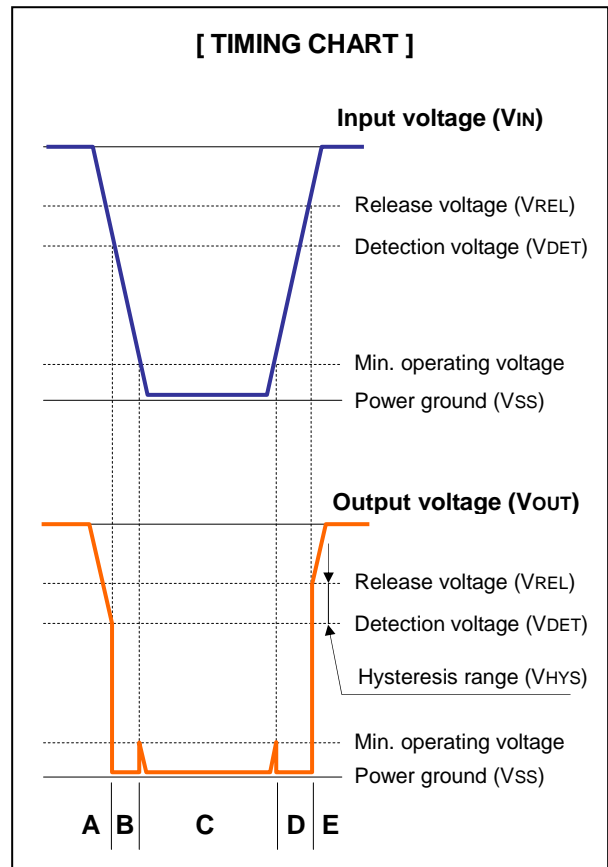
## DESCRIPTION OF OPERATION

- **General operation (CMOS Output)**

In reference to following the block diagram of CMOS output VDA series ;

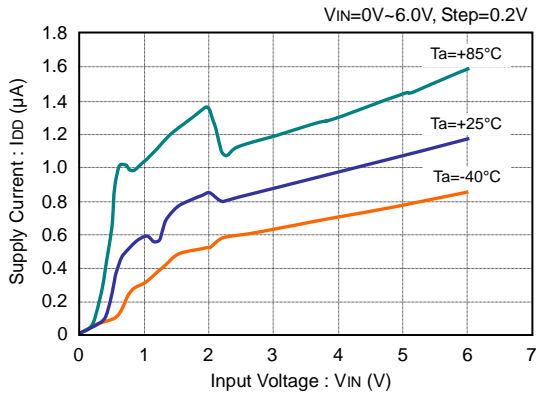


- A. When the input voltage ( $V_{IN}$ ) is higher than the release voltage ( $V_{REL}$ ), the input voltage ( $V_{IN}$ ) is provided at the output terminal because N-ch transistor is OFF and the P-ch transistor is ON. And, the output maintains the same level of input as long as the input voltage remains above the detection voltage ( $V_{DET}$ ).
- B. When the input voltage ( $V_{IN}$ ) falls below the detection voltage ( $V_{DET}$ ), the N-ch transistor is ON and the P-ch transistor is OFF. And, the output voltage ( $V_{OUT}$ ) is same as ground level ( $V_{SS}$ ).
- C. When the input voltage ( $V_{IN}$ ) falls below the minimum operating voltage, the output becomes unstable, or goes to  $V_{IN}$  when the output is pulled up to  $V_{IN}$ .
- D. When the input voltage ( $V_{IN}$ ) rises above the minimum voltage, the ground voltage ( $V_{SS}$ ) level is maintained even though the input voltage ( $V_{IN}$ ) rises above the detection voltage ( $V_{DET}$ ) as long as it does not exceed the release voltage ( $V_{REL}$ ) level.
- E. When the input voltage ( $V_{IN}$ ) rises above the release voltage ( $V_{REL}$ ), the N-ch transistor becomes OFF and the P-Ch transistor becomes ON. And, the output voltage ( $V_{OUT}$ ) is equal to input voltage ( $V_{IN}$ ). This difference between  $V_{DET}$  and  $V_{REL}$  is hysteresis range ( $V_{HYS}$ ).

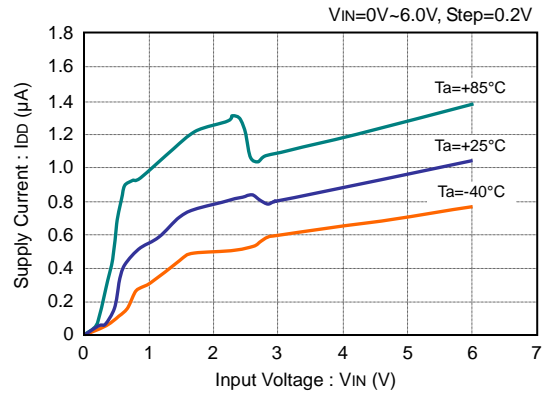


**TYPICAL CHARACTERISTICS – Supply Current vs. Input Voltage**

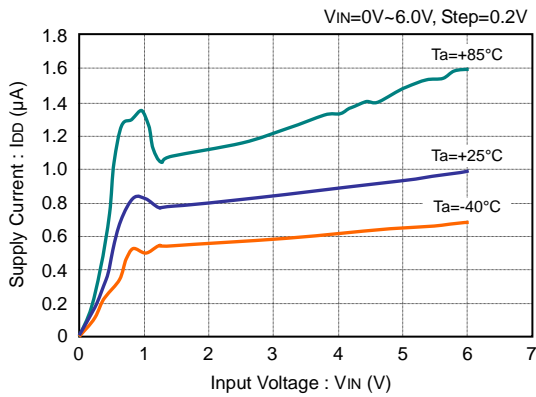
● **VDA2010CTA (CMOS 2.0V)**



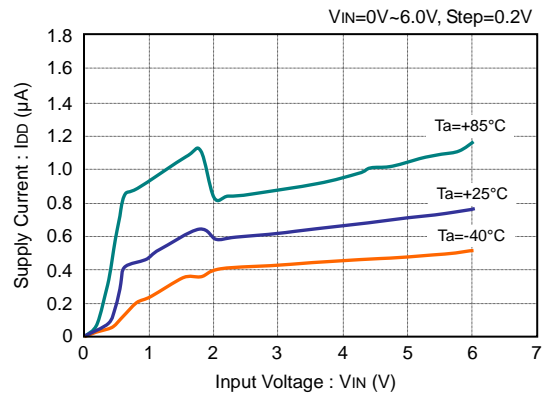
● **VDA2510CTA (CMOS 2.5V)**



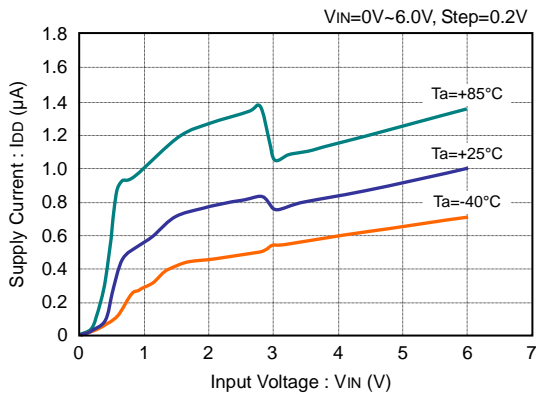
● **VDA1020NTA (N-ch 1.0V)**



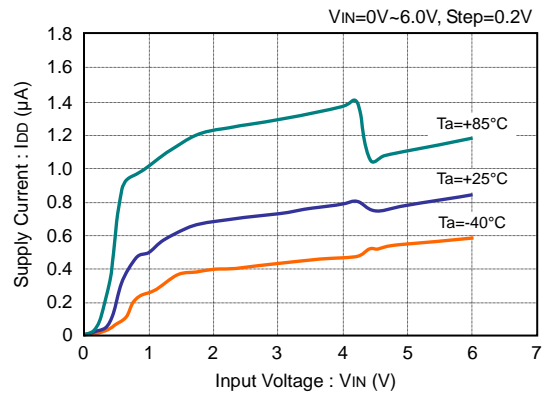
● **VDA1810NTA (N-ch 1.8V)**



● **VDA2710NTA (N-ch 2.7V)**



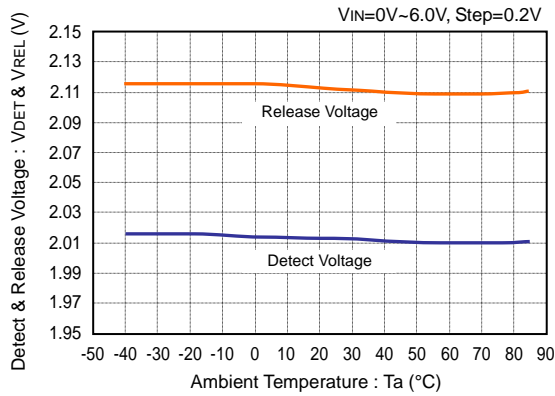
● **VDA4010NTA (N-ch 4.0V)**



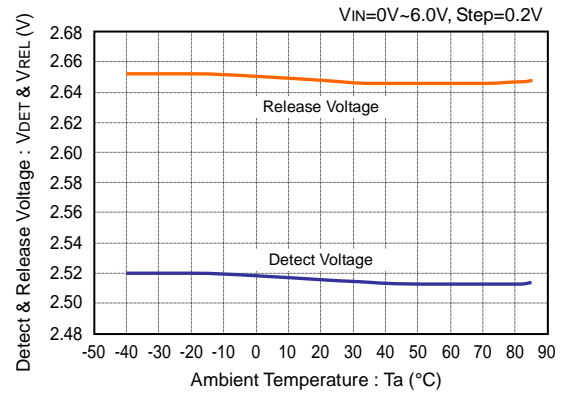


**TYPICAL CHARACTERISTICS – Detect & Release Voltage vs. Ambient Temperature**

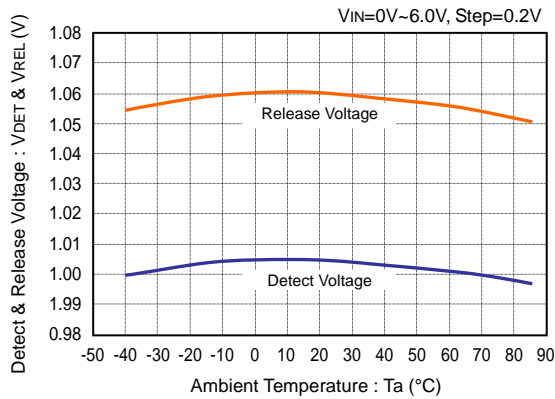
● **VDA2010CTA (CMOS 2.0V)**



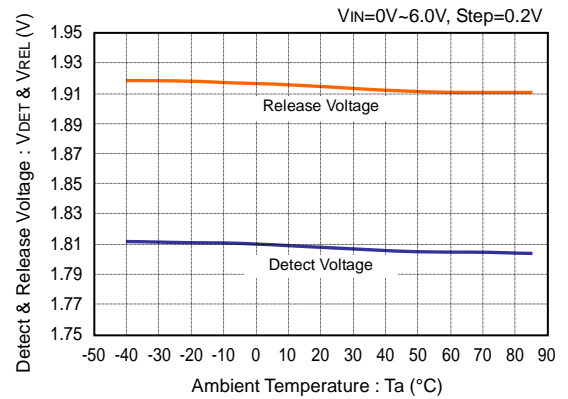
● **VDA2510CTA (CMOS 2.5V)**



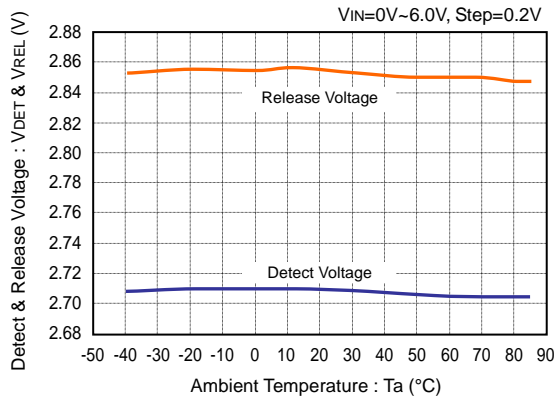
● **VDA1020NTA (N-ch 1.0V)**



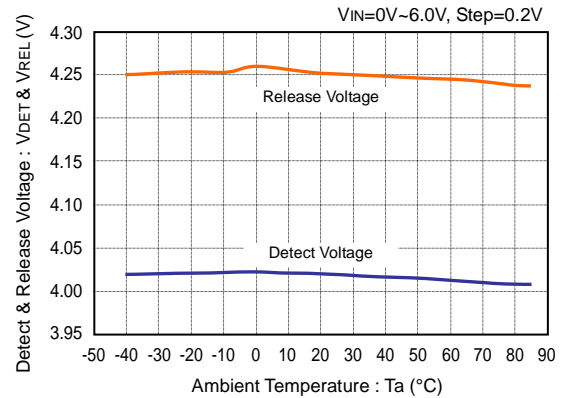
● **VDA1810NTA (N-ch 1.8V)**



● **VDA2710NTA (N-ch 2.7V)**

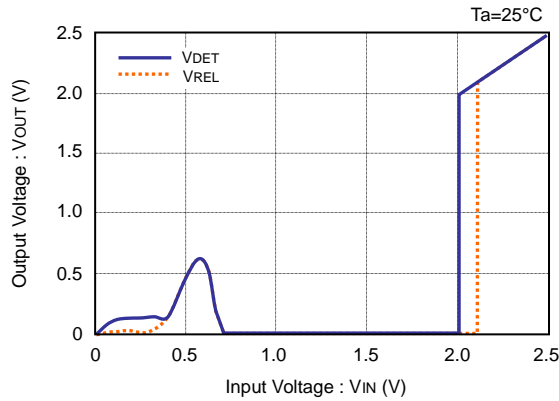


● **VDA4010NTA (N-ch 4.0V)**

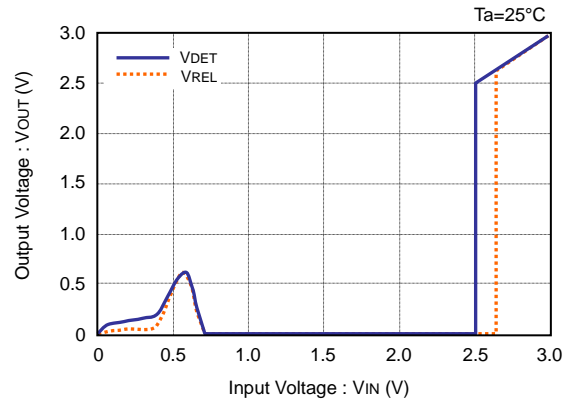


**TYPICAL CHARACTERISTICS – Output Voltage vs. Input Voltage**

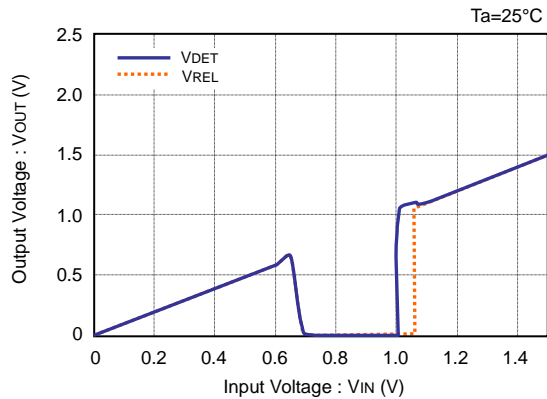
● **VDA2010CTA (CMOS 2.0V)**



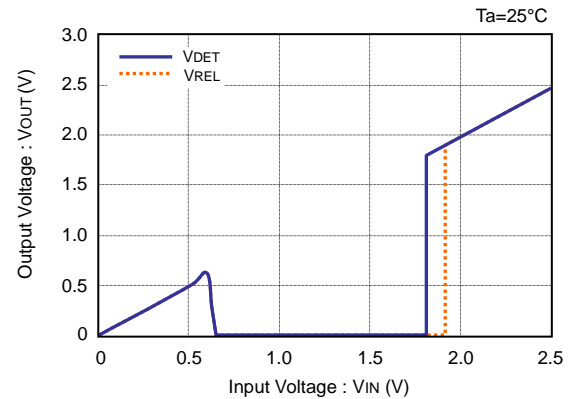
● **VDA2510CTA (CMOS 2.5V)**



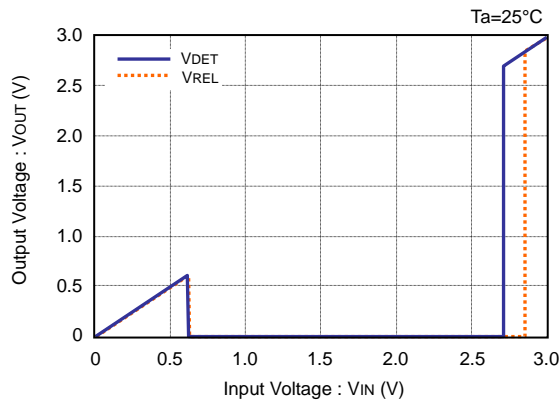
● **VDA1020NTA (N-ch 1.0V)**



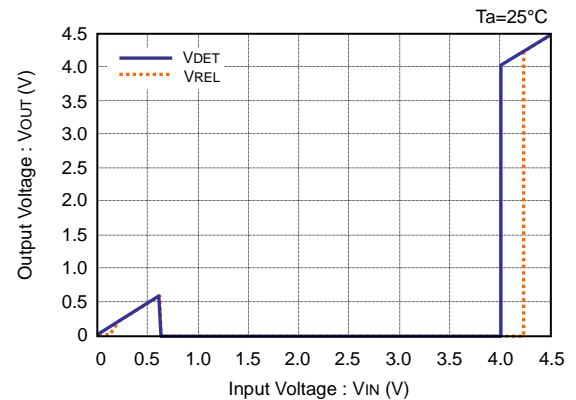
● **VDA1810NTA (N-ch 1.8V)**



● **VDA2710NTA (N-ch 2.7V)**

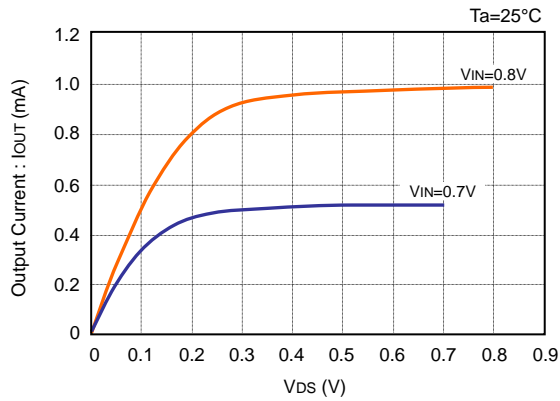


● **VDA4010NTA (N-ch 4.0V)**

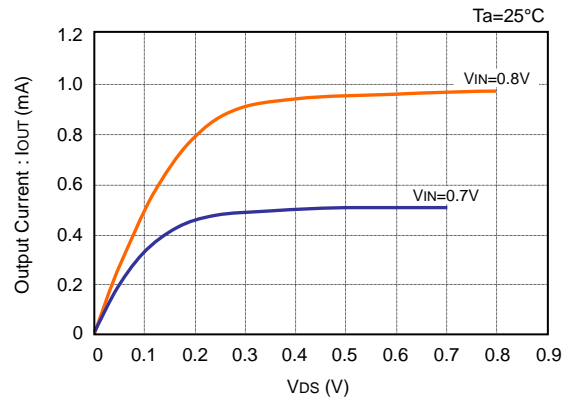


**TYPICAL CHARACTERISTICS – N-ch Driver Output Current vs.  $V_{DS}$**

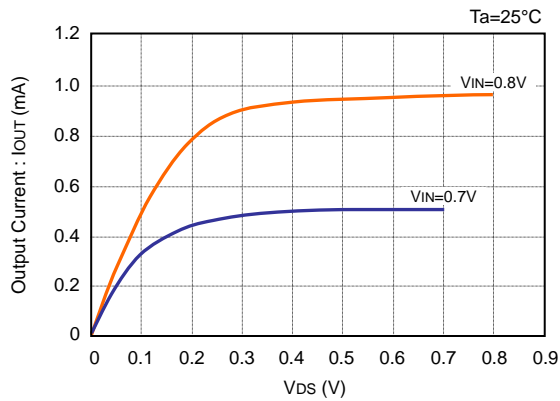
● **VDA2010CTA (CMOS 2.0V)**



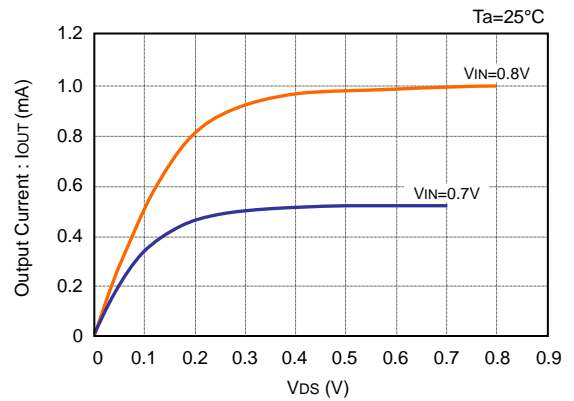
● **VDA2510CTA (CMOS 2.5V)**



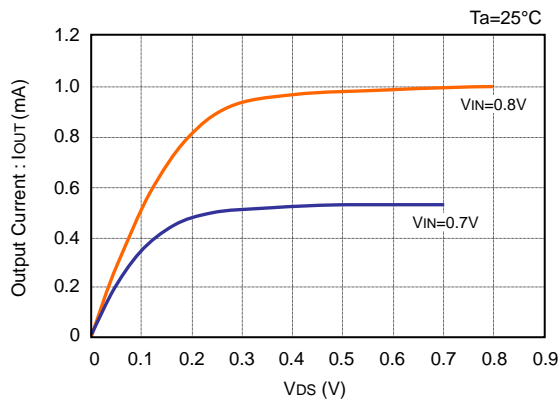
● **VDA1020NTA (N-ch 1.0V)**



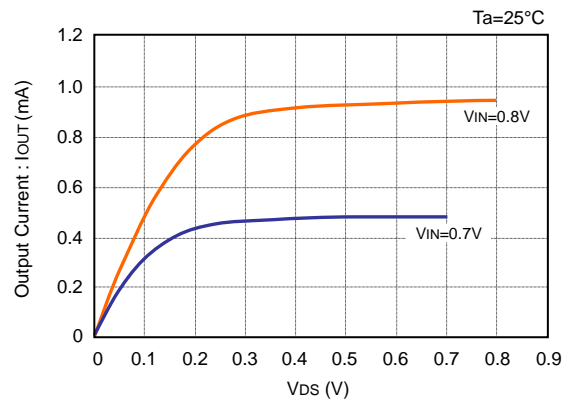
● **VDA1810NTA (N-ch 1.8V)**



● **VDA2710NTA (N-ch 2.7V)**

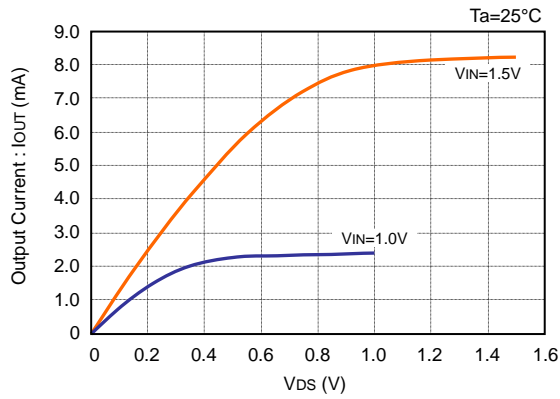


● **VDA4010NTA (N-ch 4.0V)**

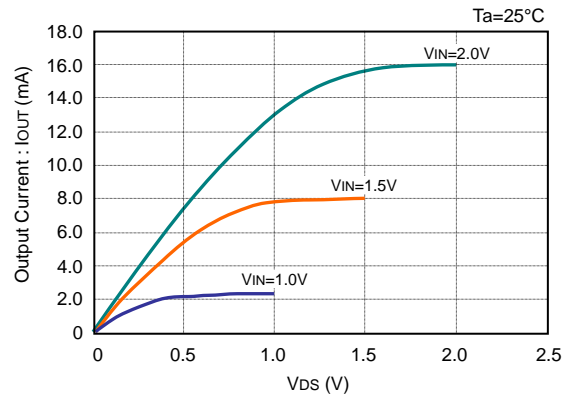


**TYPICAL CHARACTERISTICS – N-ch Driver Output Current vs. V<sub>DS</sub> (continued)**

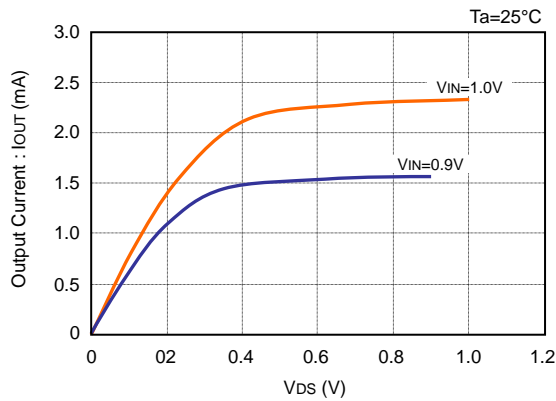
● **VDA2010CTA (CMOS 2.0V)**



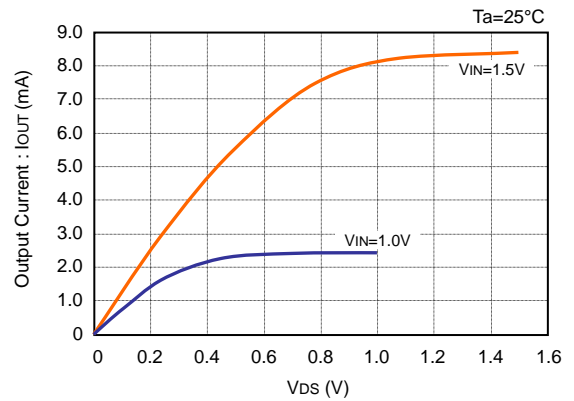
● **VDA2510CTA (CMOS 2.5V)**



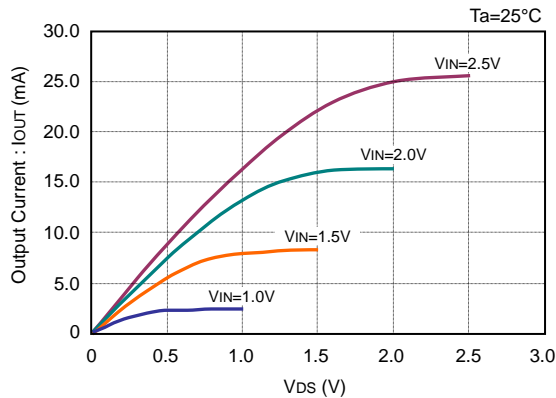
● **VDA1020NTA (N-ch 1.0V)**



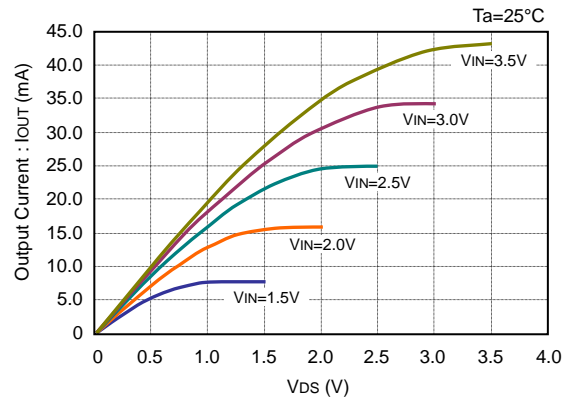
● **VDA1810NTA (N-ch 1.8V)**



● **VDA2710NTA (N-ch 2.7V)**

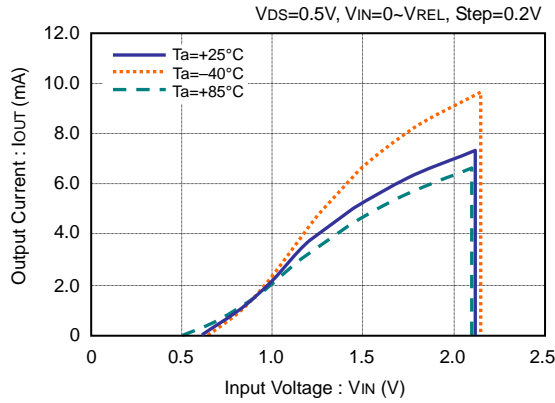


● **VDA4010NTA (N-ch 4.0V)**

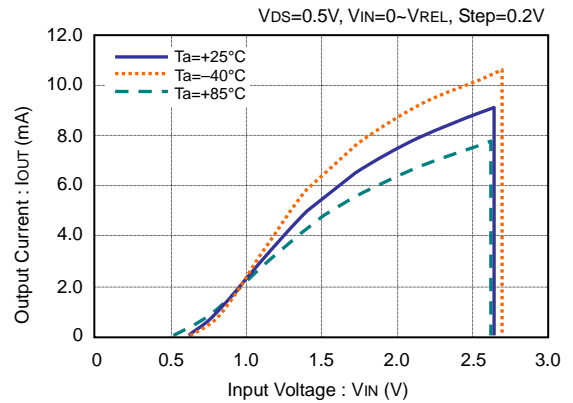


**TYPICAL CHARACTERISTICS – N-ch Driver Output Current vs. Input Voltage**

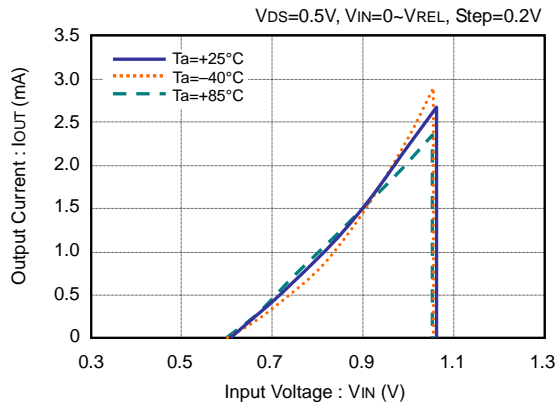
● **VDA2010CTA (CMOS 2.0V)**



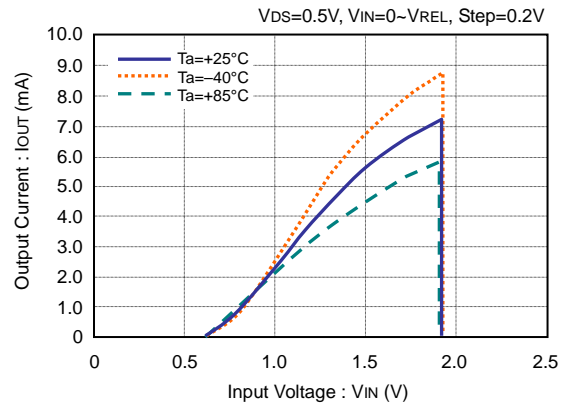
● **VDA2510CTA (CMOS 2.5V)**



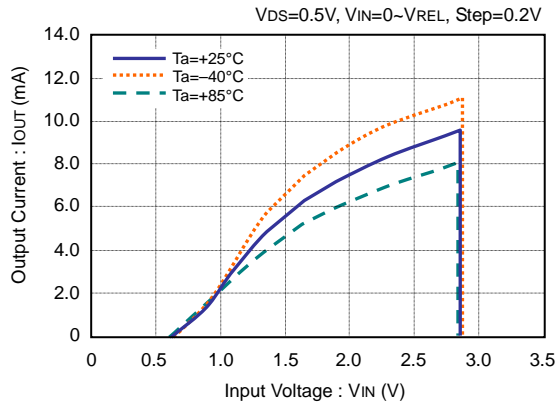
● **VDA1020NTA (N-ch 1.0V)**



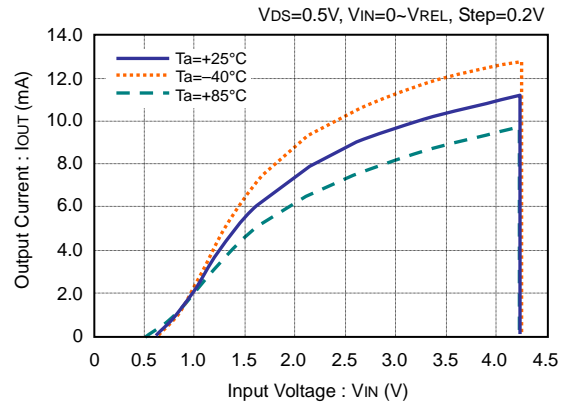
● **VDA1810NTA (N-ch 1.8V)**



● **VDA2710NTA (N-ch 2.7V)**

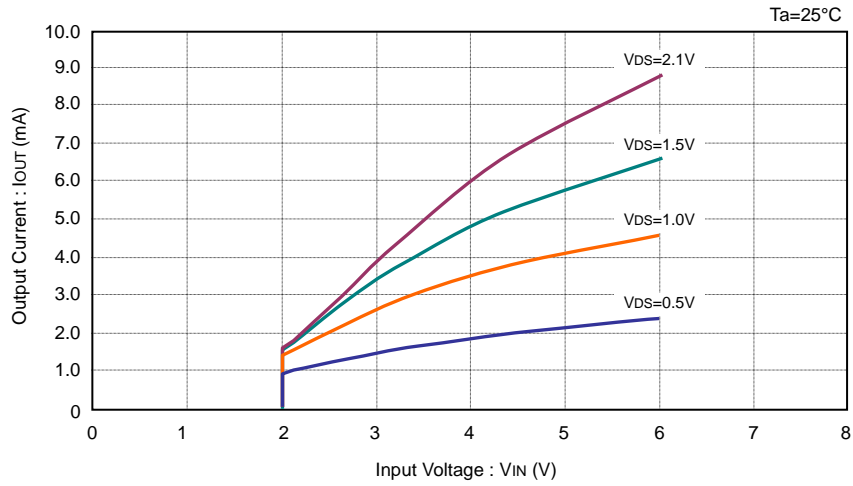


● **VDA4010NTA (N-ch 4.0V)**

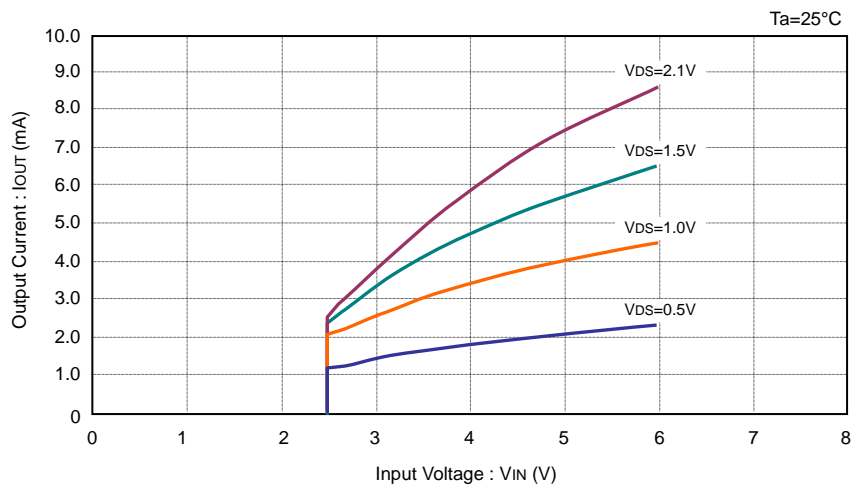


**TYPICAL CHARACTERISTICS – P-ch Driver Output Current vs. Input Voltage**

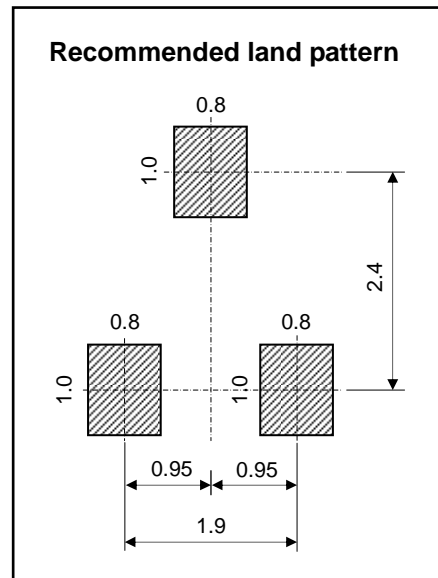
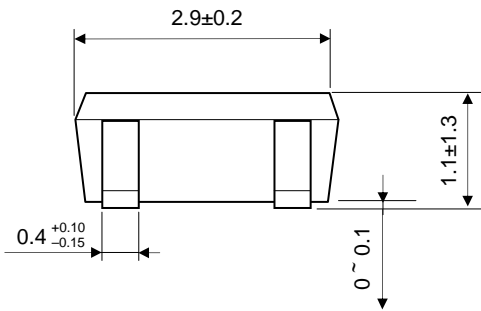
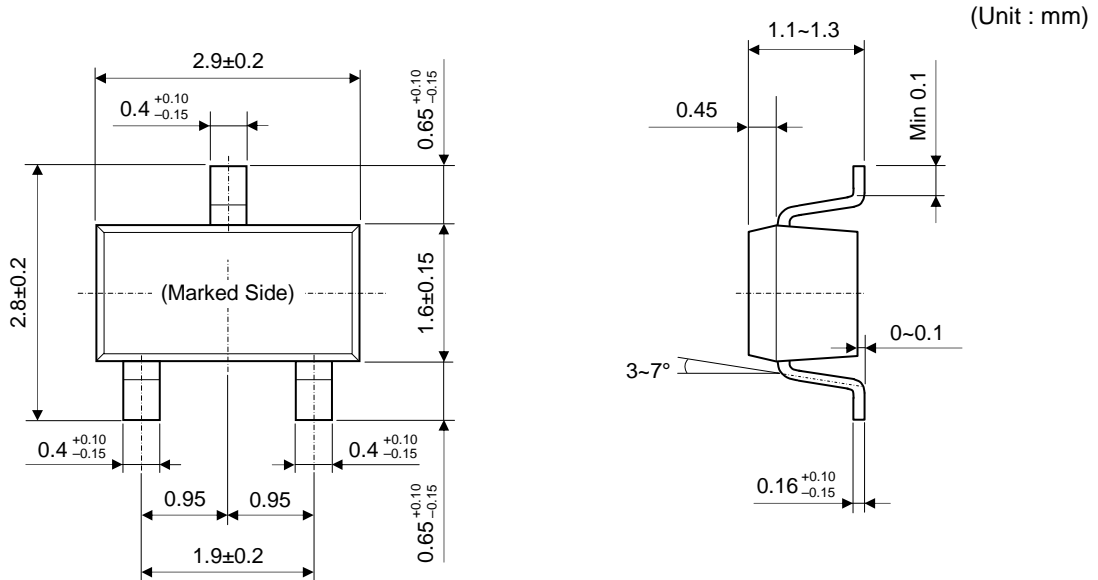
● **VDA2010CTA (CMOS 2.0V)**



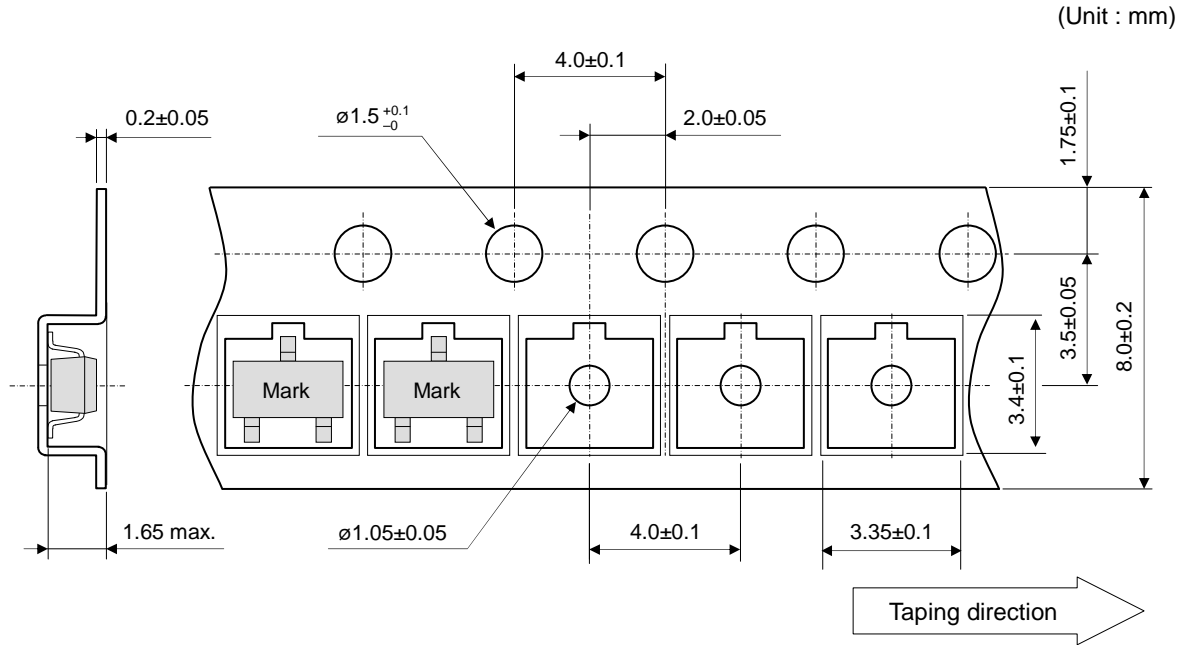
● **VDA2510CTA (CMOS 2.5V)**



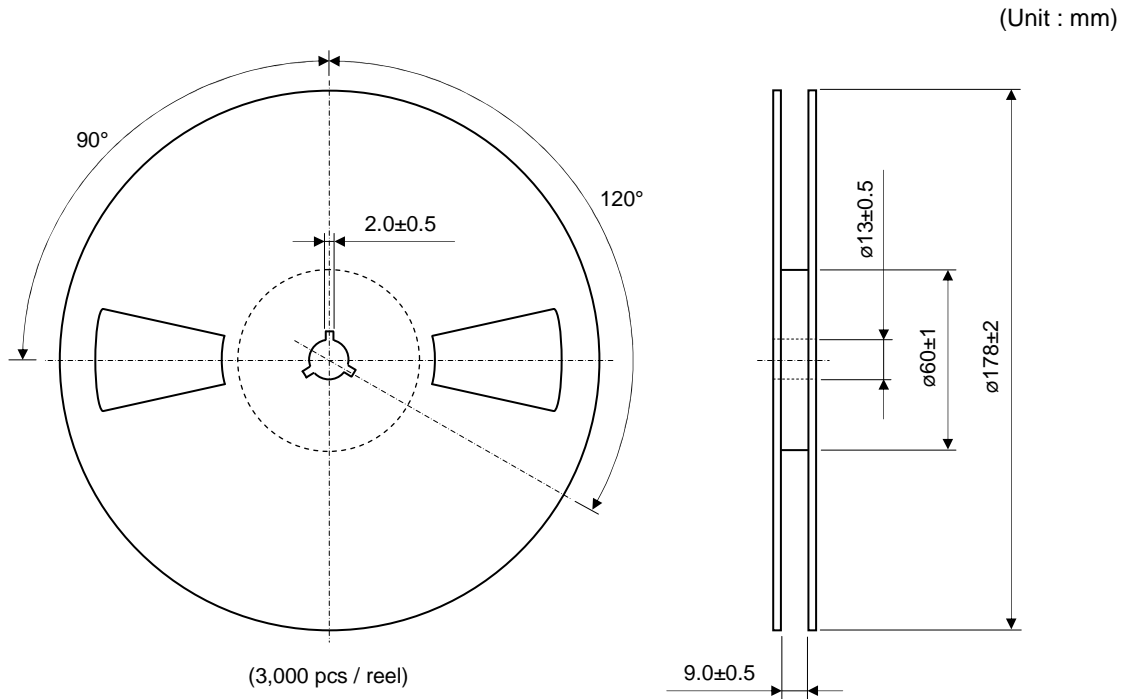
**PACKAGE DIMENSIONS (SOT-23)**



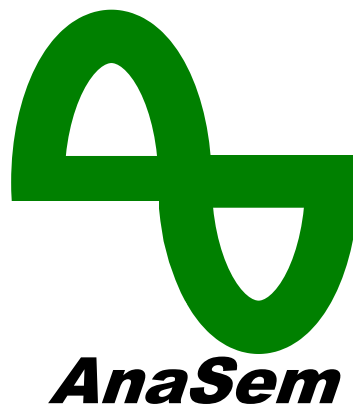
**TAPING AND LOADING SPECIFICATIONS (SOT-23)**



**REEL DIMENSIONS (SOT-23)**

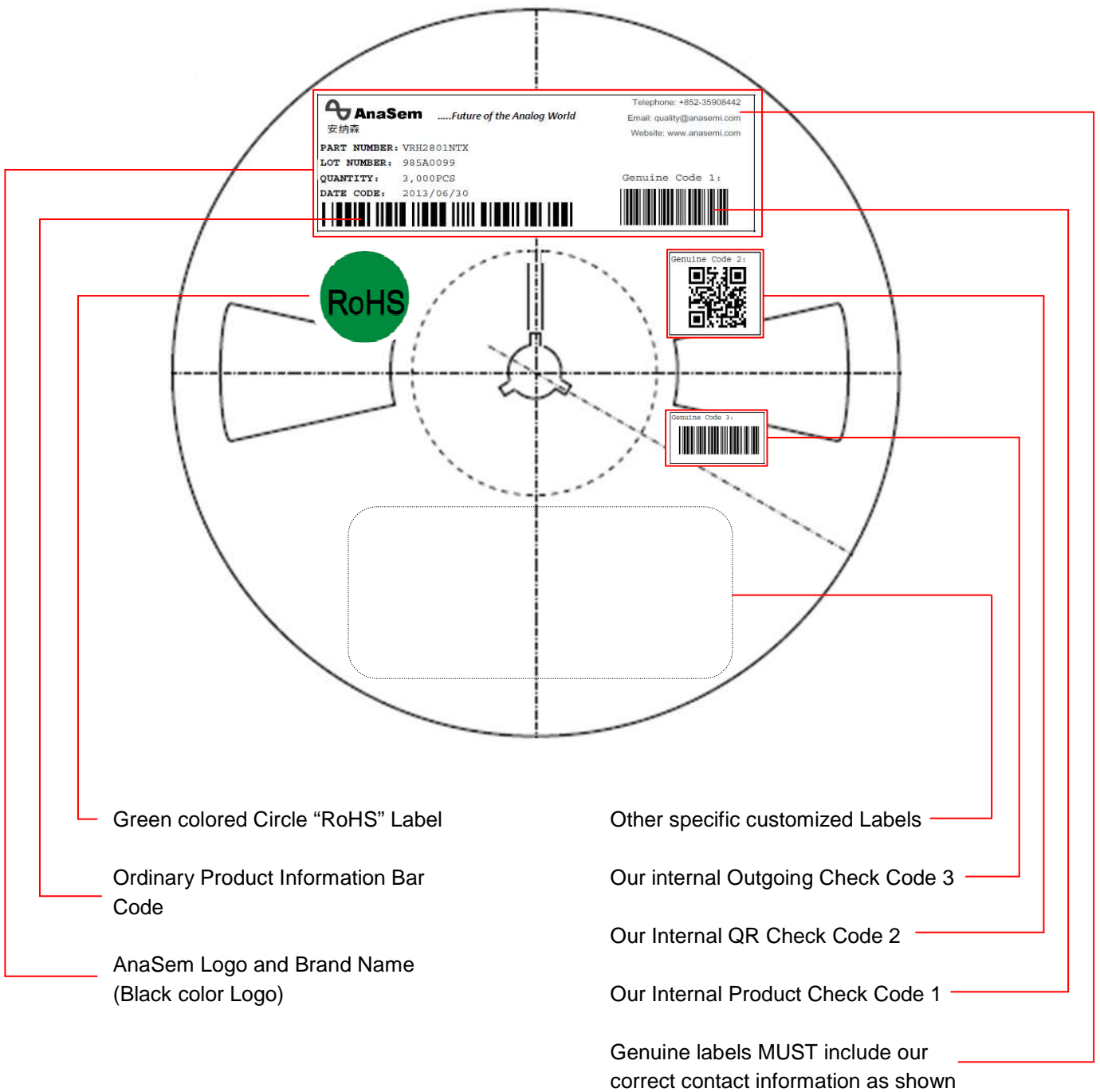






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