



**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

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**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.



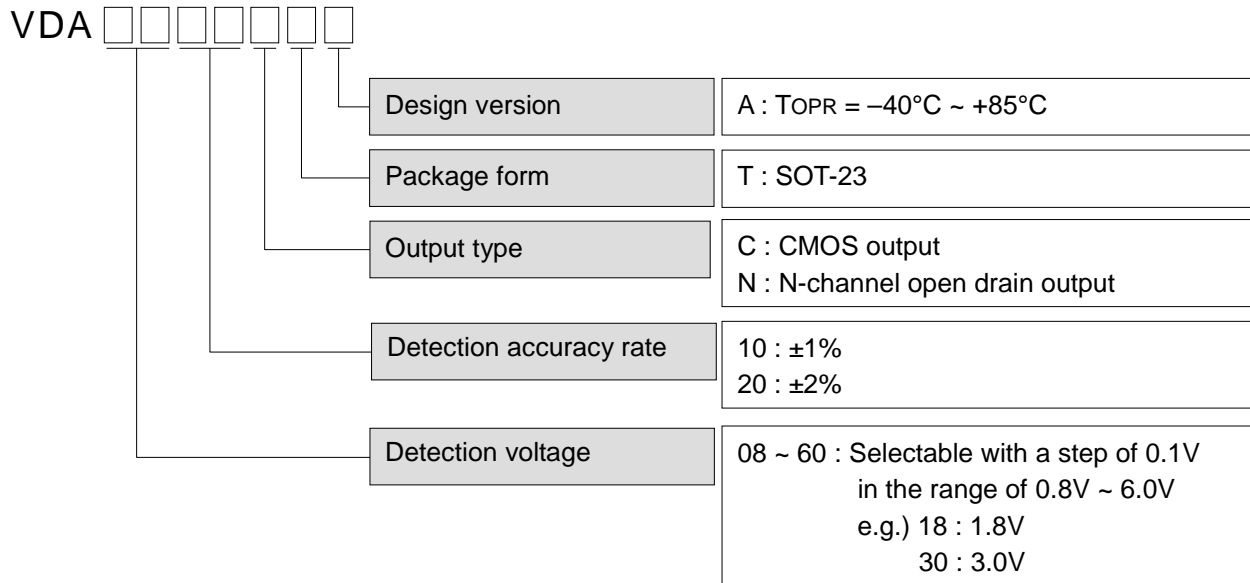
### FEATURES

- 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)

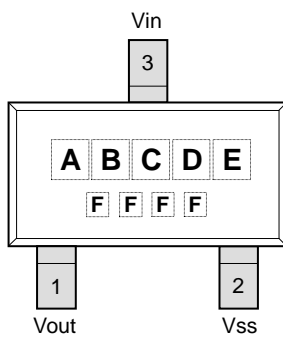
### APPLICATIONS

- 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**

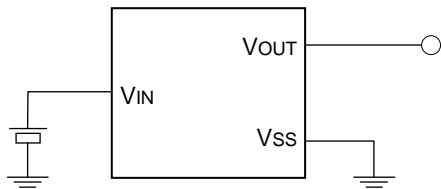
No.	Symbol	Descriptions
1	VOUT	Output
2	VSS	Power ground
3	VIN	Voltage input

● **Marking Specification**

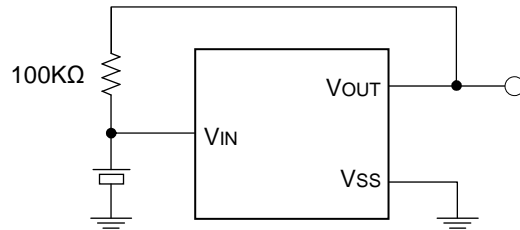
Code	Mark	Contents
A	C or N	Output type
BC	08~60	Detection voltage
D	1 or 2	Detection accuracy rate
E	A	Version
F	Internal rule	Lot number

## TYPICAL APPLICATION CIRCUITS

- CMOS output

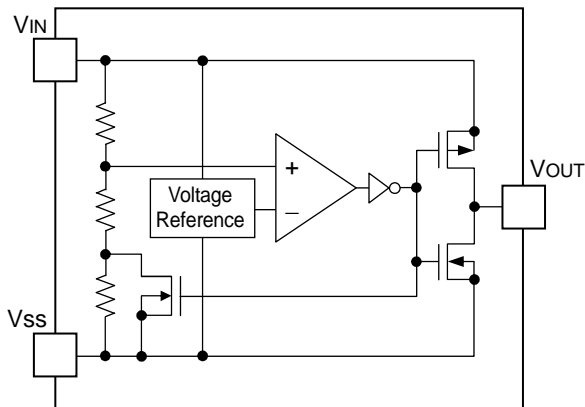


- N-channel open drain output

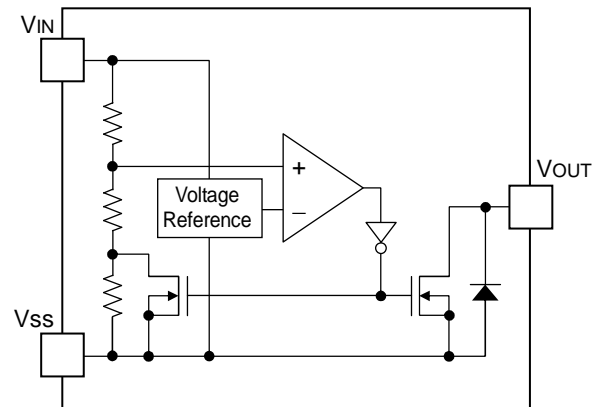


## BLOCK DIAGRAM

- 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.

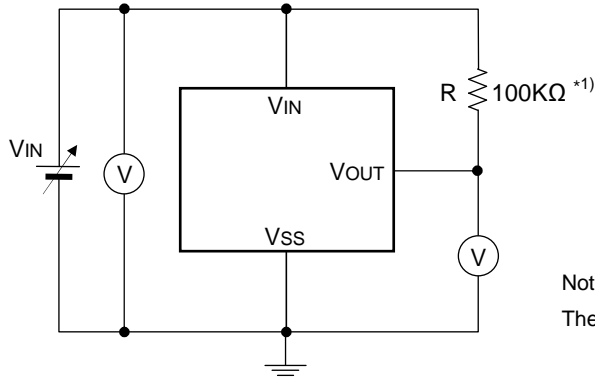
## ELECTRICAL CHARACTERISTICS

(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 Ta = -40°C ~ +85°C	V <sub>DET</sub> ×0.99	V <sub>DET</sub>	V <sub>DET</sub> ×1.01	V	1	
	V <sub>DET</sub>	V <sub>DET</sub> = 0.8V ~ 1.7V Ta = -40°C ~ +85°C	V <sub>DET</sub> ×0.98	V <sub>DET</sub>	V <sub>DET</sub> ×1.02	V		
Hysteresis range	V <sub>HYS</sub>		V <sub>DET</sub> ×0.02	V <sub>DET</sub> ×0.05	V <sub>DET</sub> ×0.08	V	1	
Output current	I <sub>OUT</sub>	N-ch 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 V <sub>DS</sub> =2.1V	V <sub>IN</sub> =6.0V	-	-9.5	-1.5	mA	4	
CMOS N-ch 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 Ta = -40°C ~ +85°C	-	±20	-	ppm/°C	1	
		V <sub>DET</sub> = 0.8V ~ 1.7V Ta = -40°C ~ +85°C	-	±100	-	ppm/°C		
Delay time 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	

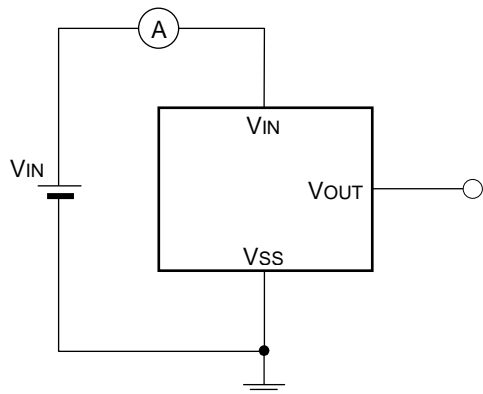
**TEST CIRCUITS**

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

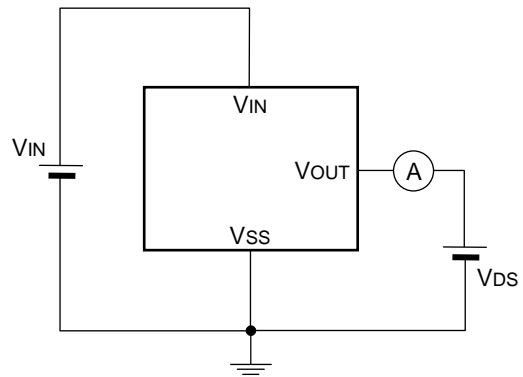


Note 1) :  
The resistor (100kΩ) is not necessary for CMOS output products.

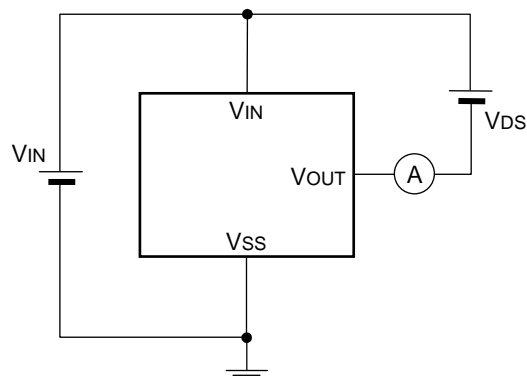
- **Circuit (2)** – Current consumption



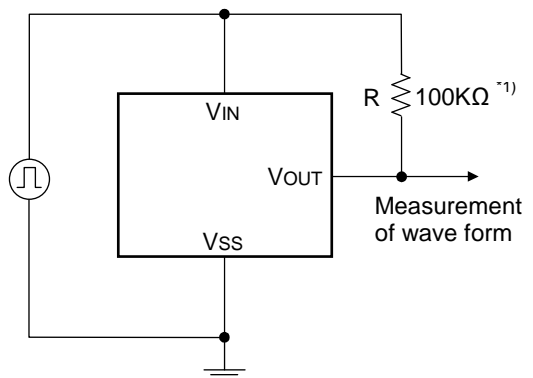
- **Circuit (3)** – N-ch driver output current



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



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

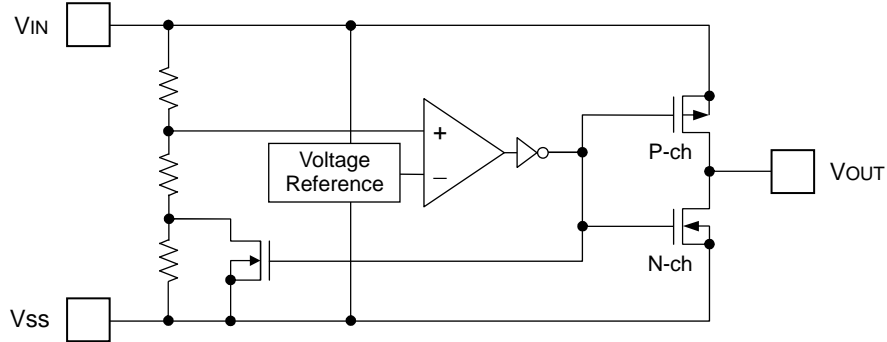


Note 1) :  
The resistor (100kΩ) is not necessary for CMOS output products.

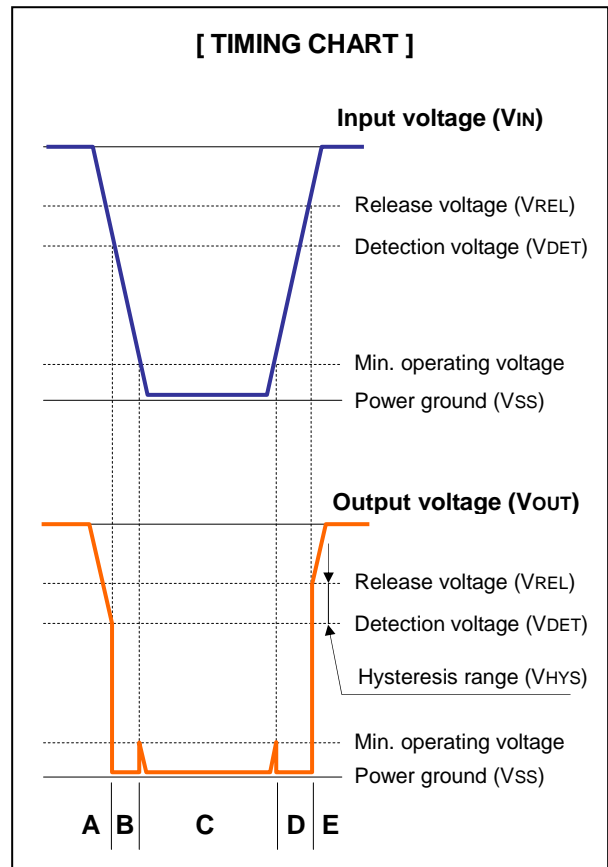
## DESCRIPTION OF OPERATION

- **General operation (CMOS Output)**

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

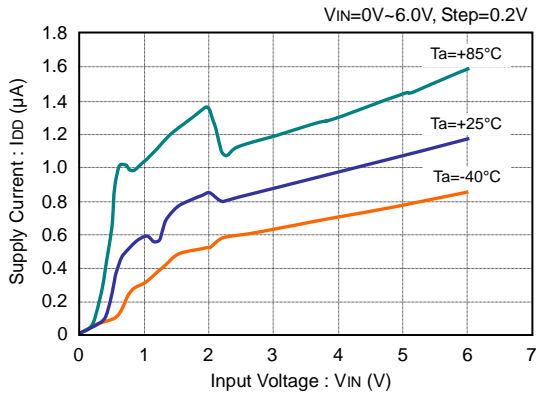


- When the input voltage ( $V_{IN}$ ) is higher than the release voltage ( $V_{REL}$ ), the input voltage ( $V_{IN}$ ) is provided at the output terminal because N-ch transistor is OFF and the P-ch transistor is ON. And, the output maintains the same level of input as long as the input voltage remains above the detection voltage ( $V_{DET}$ ).
- 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 ( $V_{SS}$ ).
- 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  $V_{IN}$ .
- 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.
- 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 ( $V_{HYS}$ ).

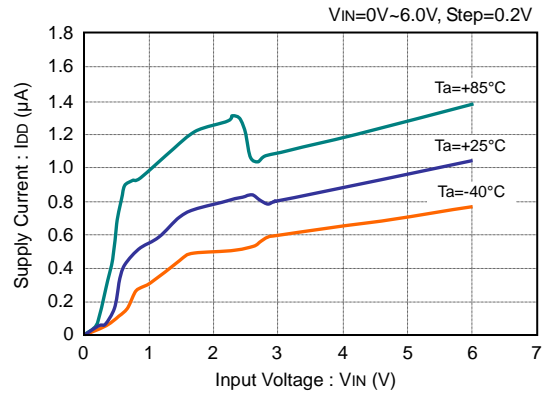


**TYPICAL CHARACTERISTICS – Supply Current vs. Input Voltage**

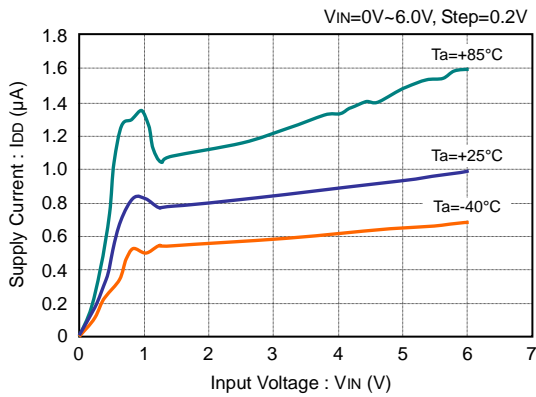
● **VDA2010CTA (CMOS 2.0V)**



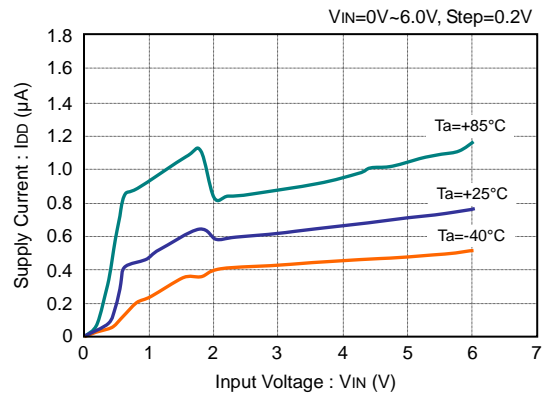
● **VDA2510CTA (CMOS 2.5V)**



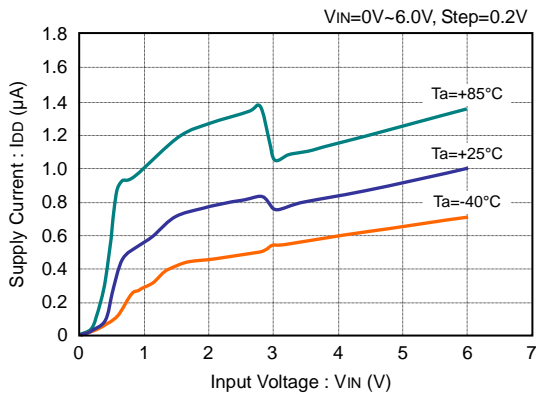
● **VDA1020NTA (N-ch 1.0V)**



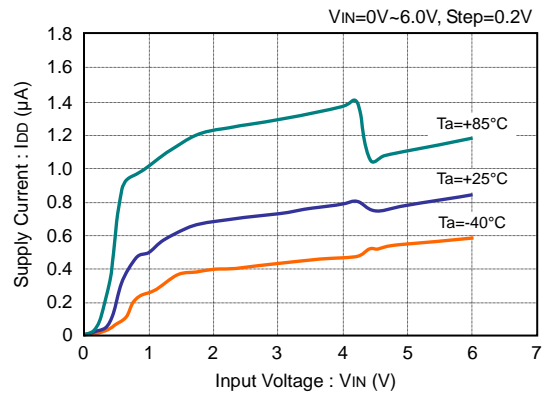
● **VDA1810NTA (N-ch 1.8V)**



● **VDA2710NTA (N-ch 2.7V)**



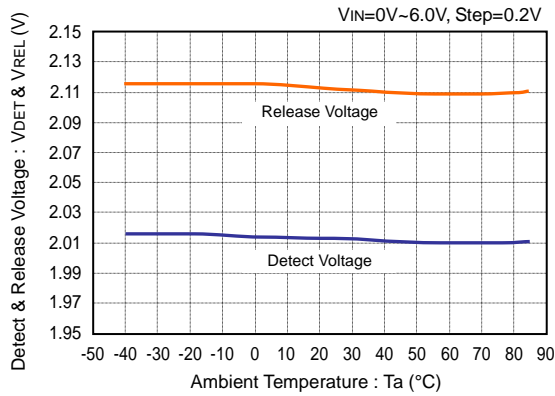
● **VDA4010NTA (N-ch 4.0V)**



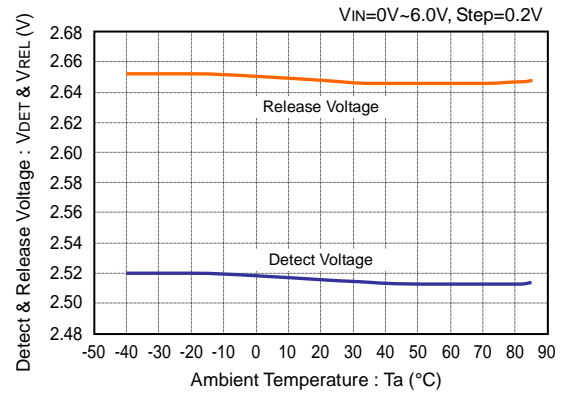


**TYPICAL CHARACTERISTICS – Detect & Release Voltage vs. Ambient Temperature**

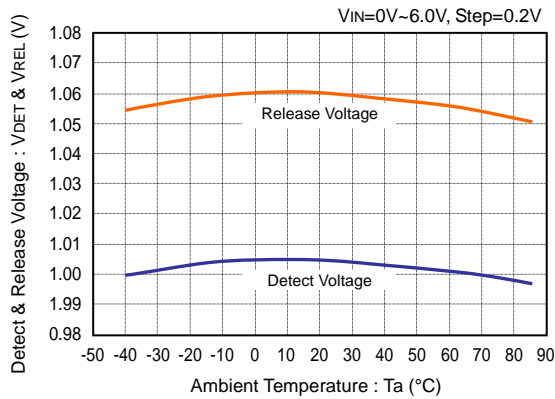
● **VDA2010CTA (CMOS 2.0V)**



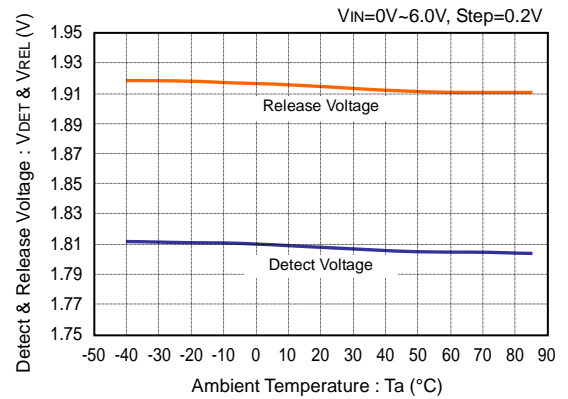
● **VDA2510CTA (CMOS 2.5V)**



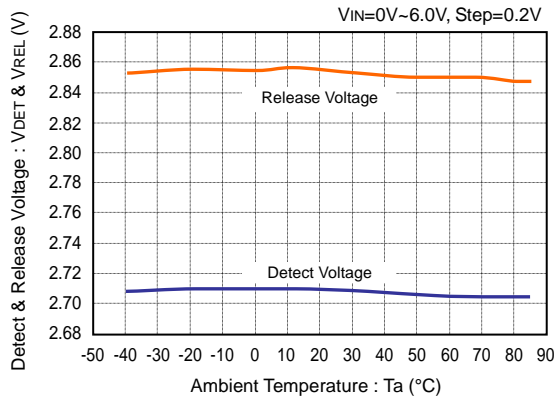
● **VDA1020NTA (N-ch 1.0V)**



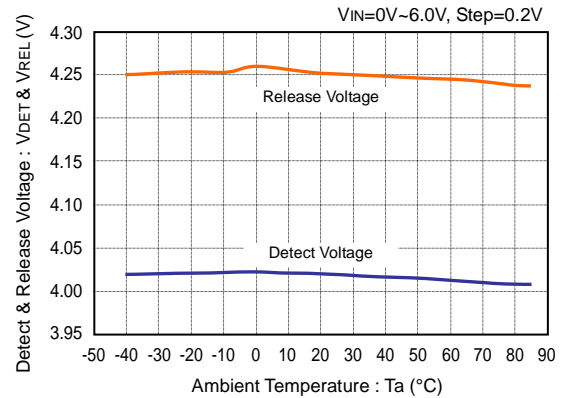
● **VDA1810NTA (N-ch 1.8V)**



● **VDA2710NTA (N-ch 2.7V)**

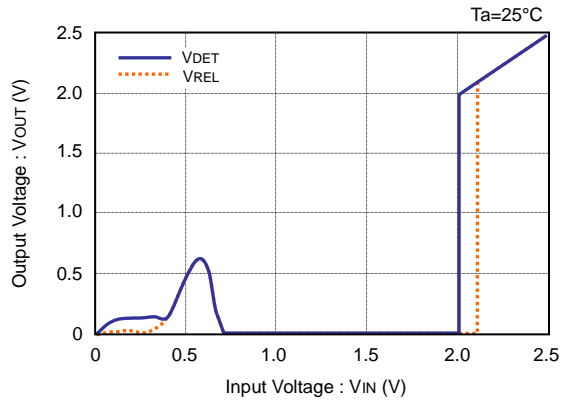


● **VDA4010NTA (N-ch 4.0V)**

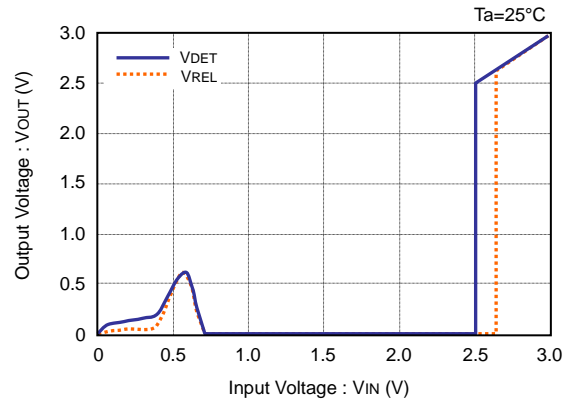


**TYPICAL CHARACTERISTICS – Output Voltage vs. Input Voltage**

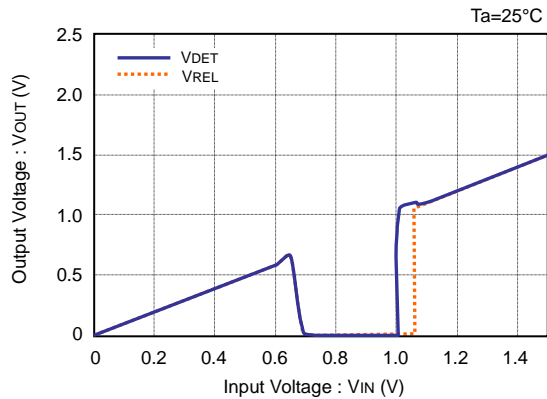
● **VDA2010CTA (CMOS 2.0V)**



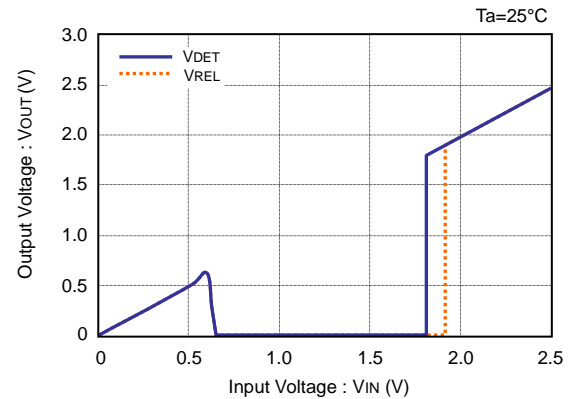
● **VDA2510CTA (CMOS 2.5V)**



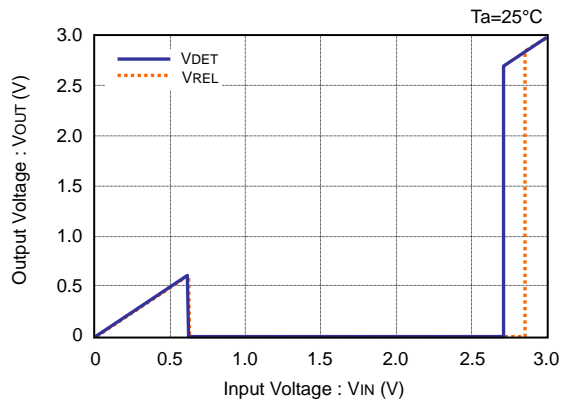
● **VDA1020NTA (N-ch 1.0V)**



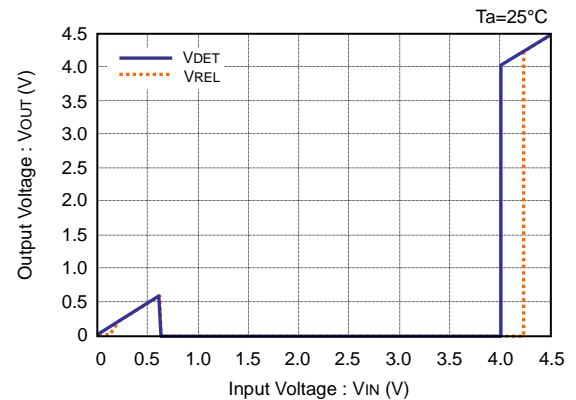
● **VDA1810NTA (N-ch 1.8V)**



● **VDA2710NTA (N-ch 2.7V)**

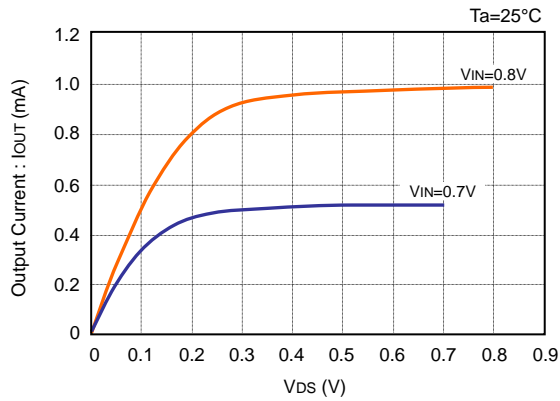


● **VDA4010NTA (N-ch 4.0V)**

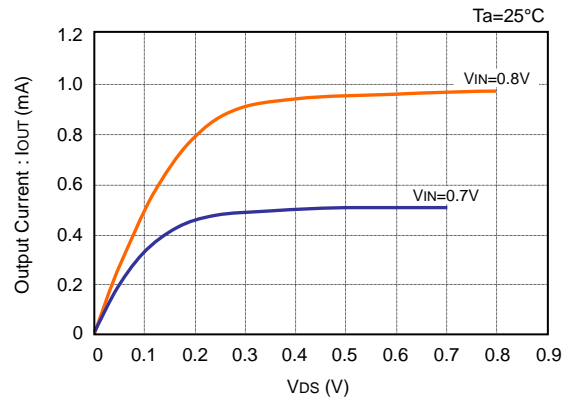


**TYPICAL CHARACTERISTICS – N-ch Driver Output Current vs.  $V_{DS}$**

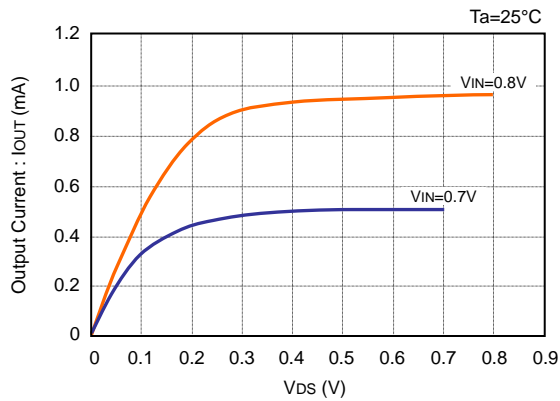
● **VDA2010CTA (CMOS 2.0V)**



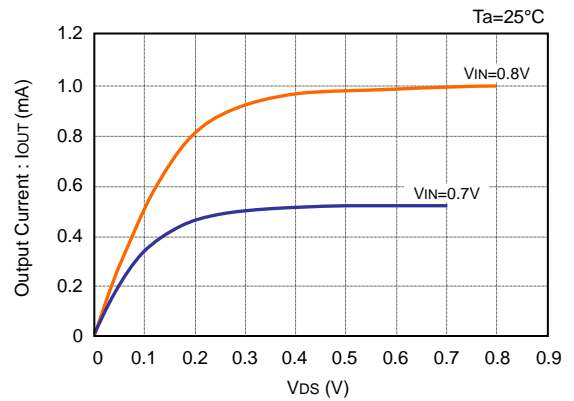
● **VDA2510CTA (CMOS 2.5V)**



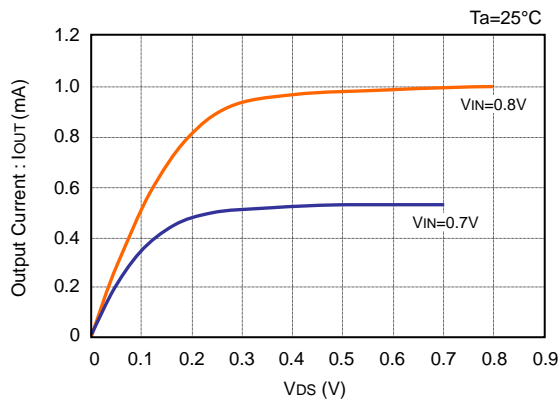
● **VDA1020NTA (N-ch 1.0V)**



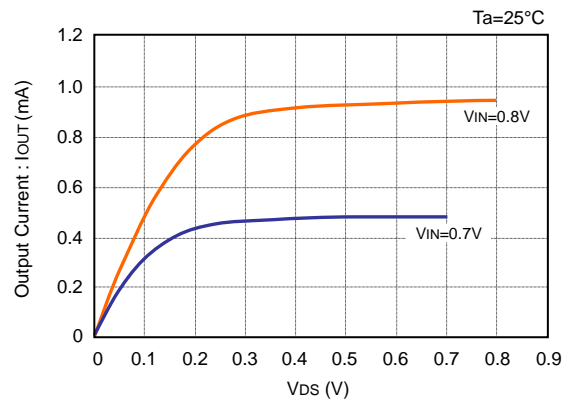
● **VDA1810NTA (N-ch 1.8V)**



● **VDA2710NTA (N-ch 2.7V)**

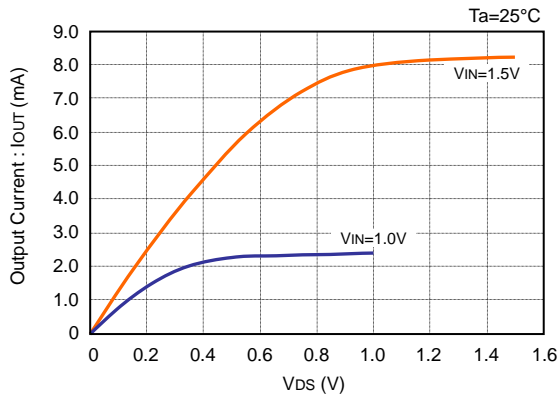


● **VDA4010NTA (N-ch 4.0V)**

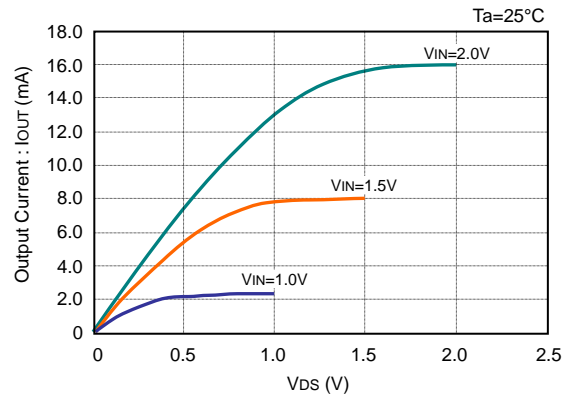


**TYPICAL CHARACTERISTICS – N-ch Driver Output Current vs. V<sub>DS</sub> (continued)**

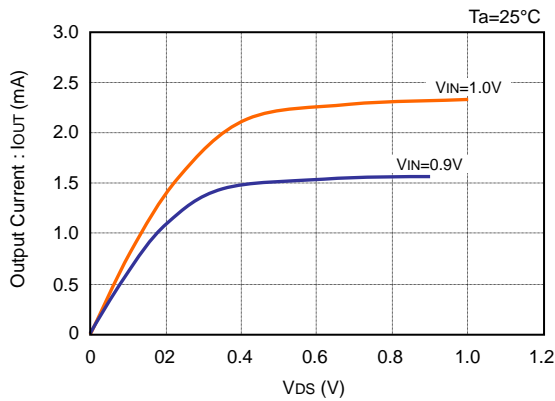
● **VDA2010CTA (CMOS 2.0V)**



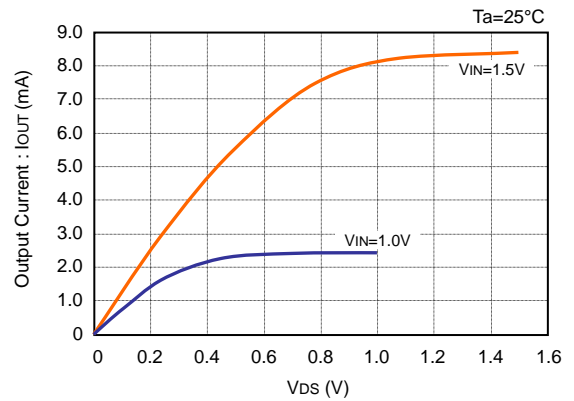
● **VDA2510CTA (CMOS 2.5V)**



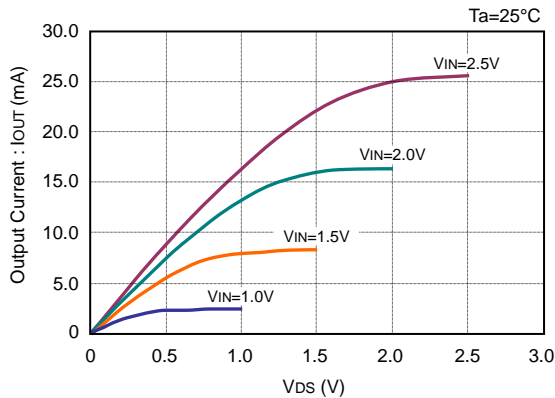
● **VDA1020NTA (N-ch 1.0V)**



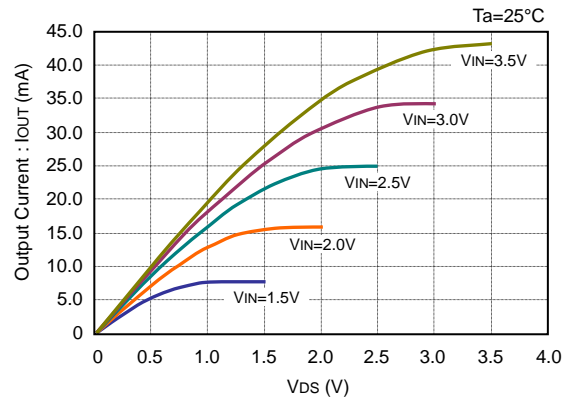
● **VDA1810NTA (N-ch 1.8V)**



● **VDA2710NTA (N-ch 2.7V)**

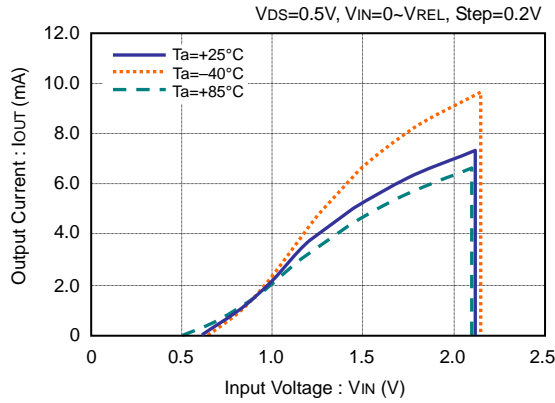


● **VDA4010NTA (N-ch 4.0V)**

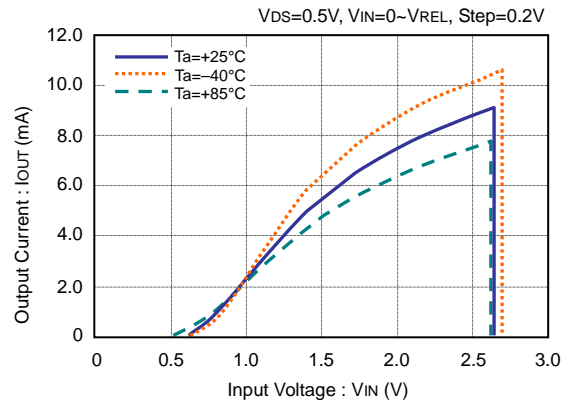


**TYPICAL CHARACTERISTICS – N-ch Driver Output Current vs. Input Voltage**

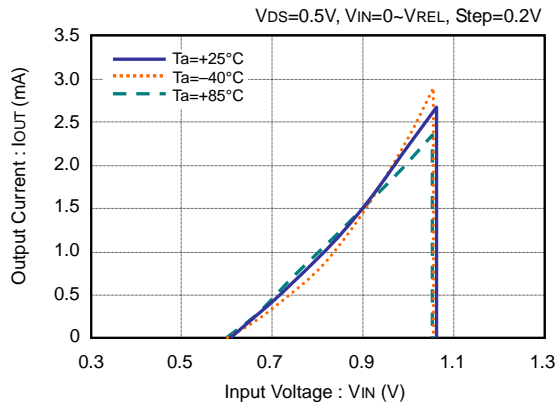
● **VDA2010CTA (CMOS 2.0V)**



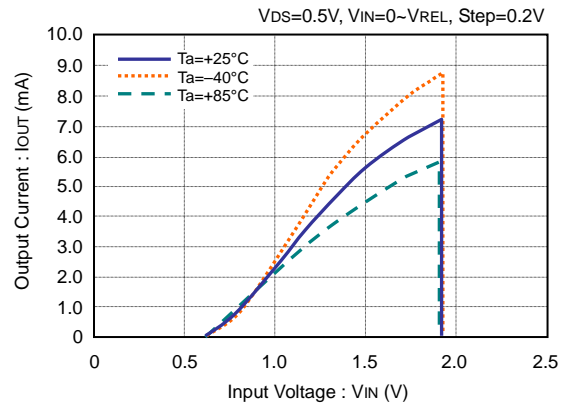
● **VDA2510CTA (CMOS 2.5V)**



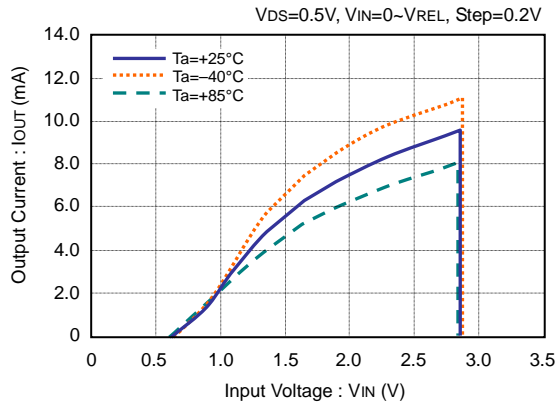
● **VDA1020NTA (N-ch 1.0V)**



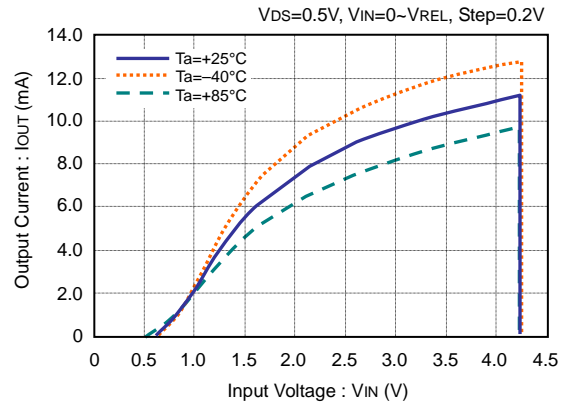
● **VDA1810NTA (N-ch 1.8V)**



● **VDA2710NTA (N-ch 2.7V)**

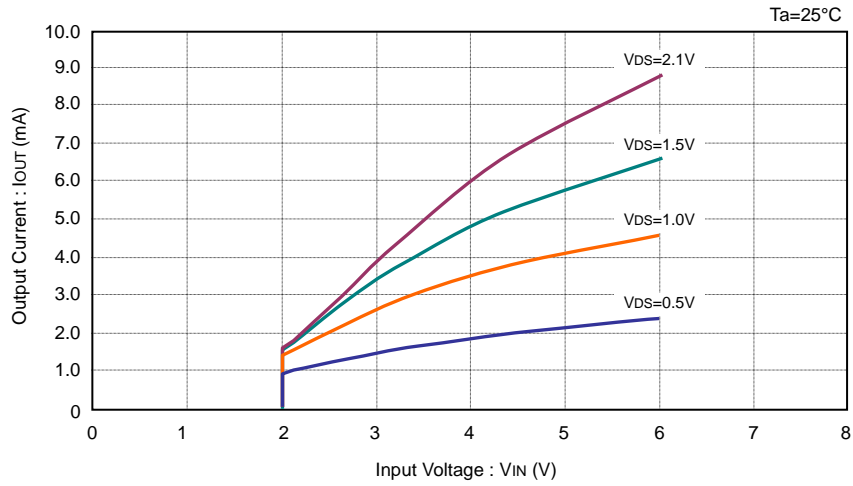


● **VDA4010NTA (N-ch 4.0V)**

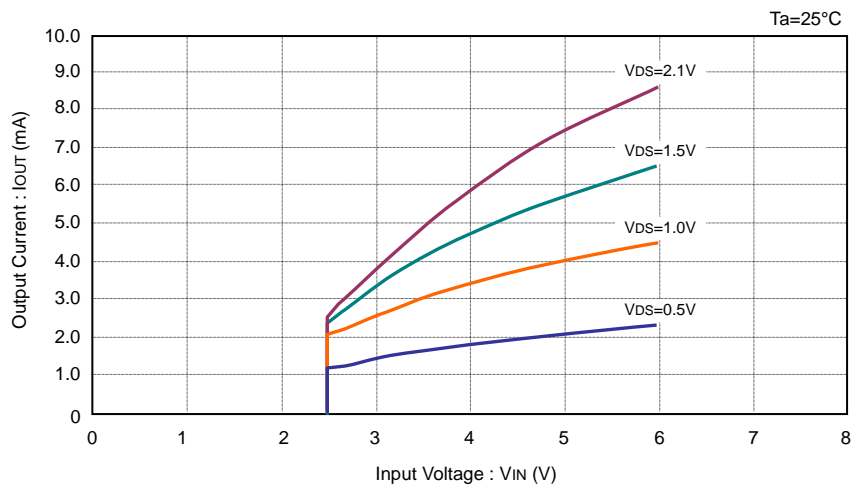


**TYPICAL CHARACTERISTICS – P-ch Driver Output Current vs. Input Voltage**

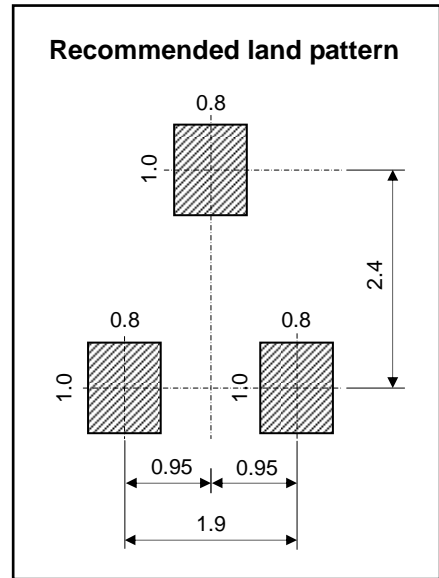
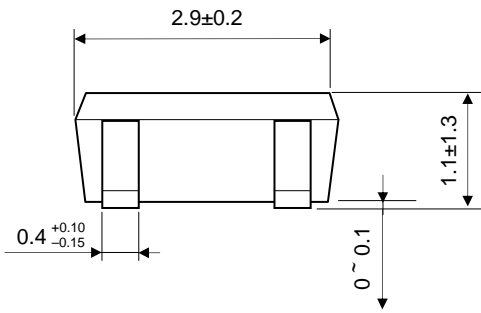
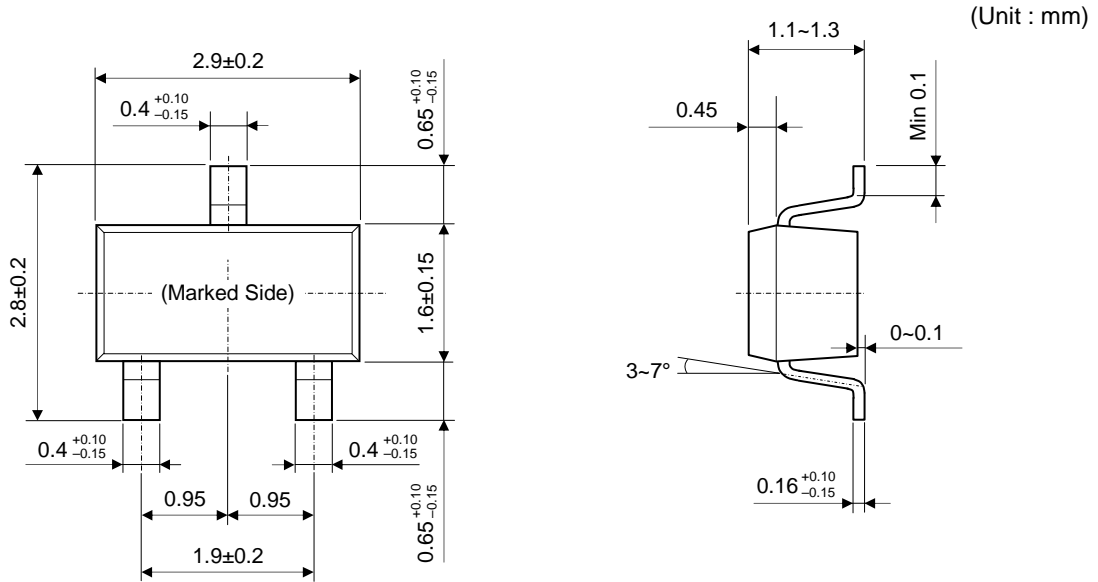
● **VDA2010CTA (CMOS 2.0V)**



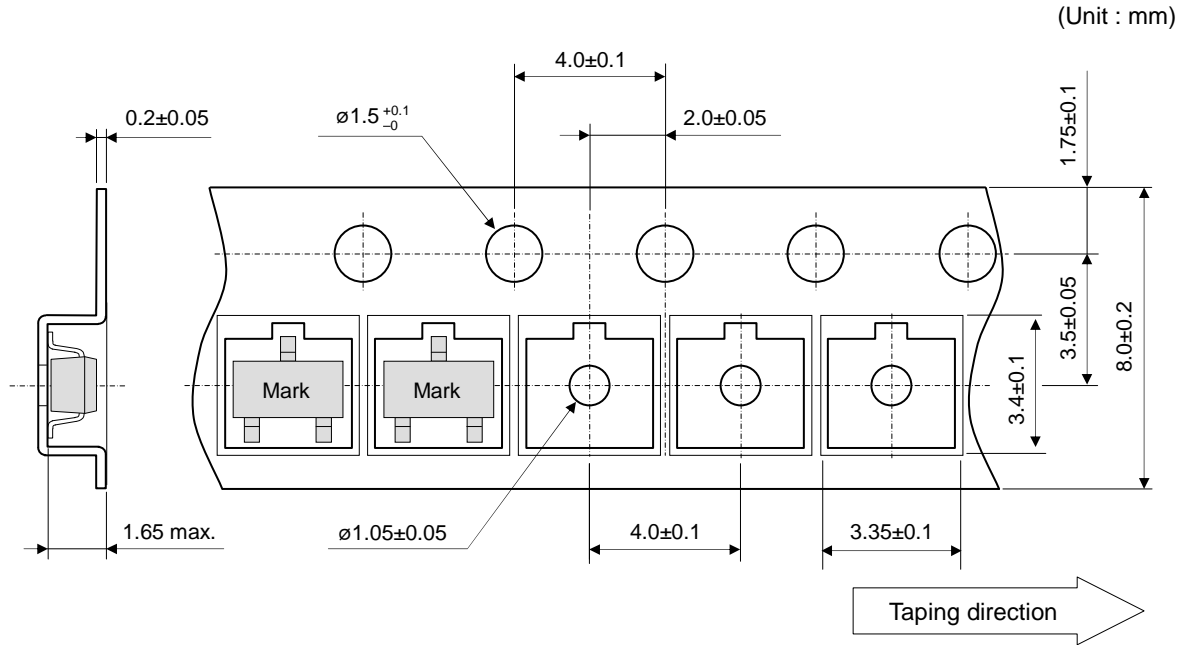
● **VDA2510CTA (CMOS 2.5V)**



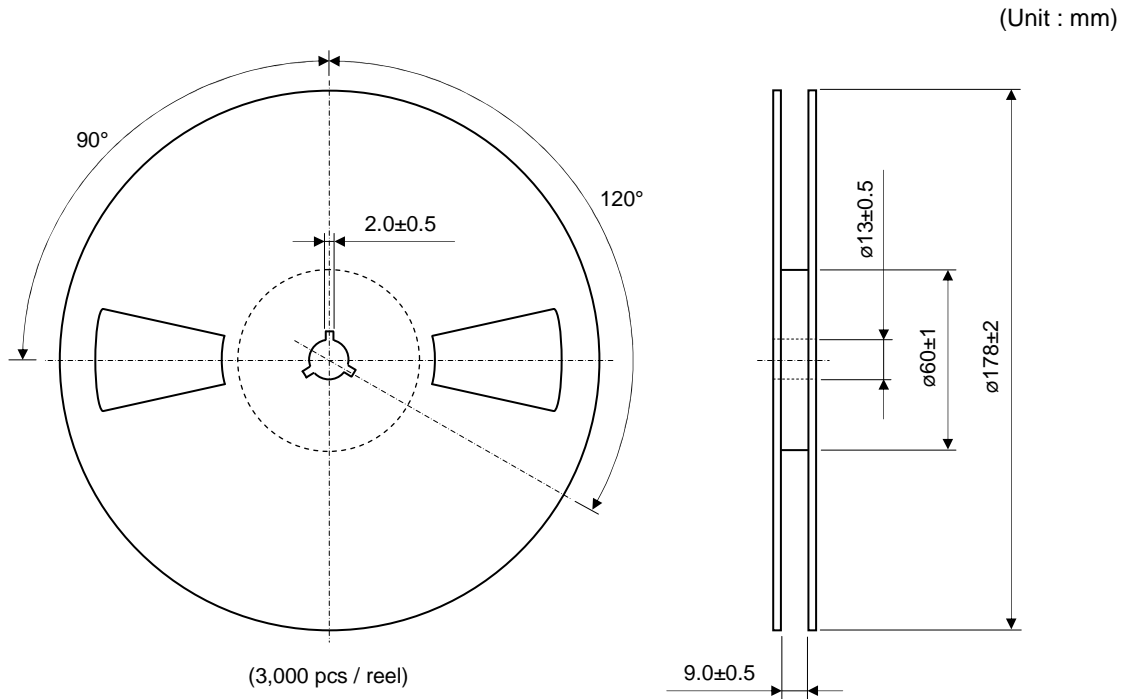
**PACKAGE DIMENSIONS (SOT-23)**



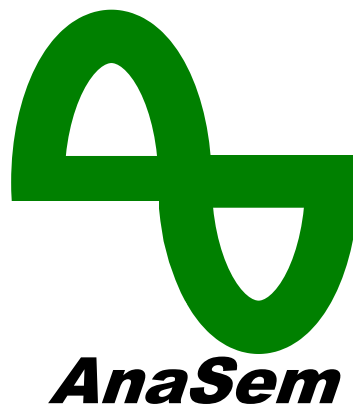
**TAPING AND LOADING SPECIFICATIONS (SOT-23)**



**REEL DIMENSIONS (SOT-23)**

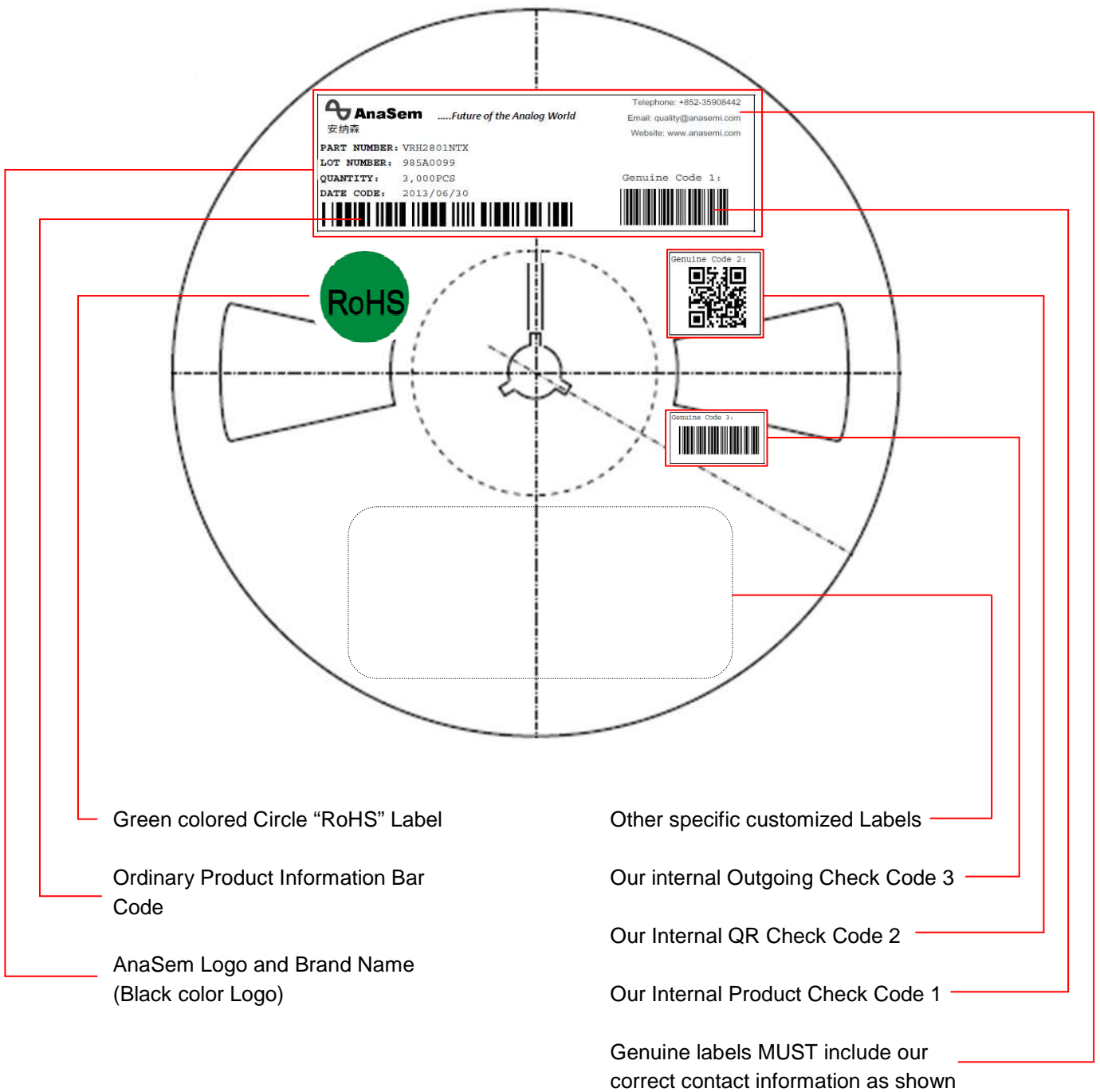






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