AnaSem
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Analog Semiconductor IC

VDD Series

Low voltage, Low power, ±1% High detect accuracy
CMOS Voltage Detector with Delay circuit

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

Rev. E13-01

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AnaSem
..... Future of the analog world

Low voltage, Low power, ±1% High detect accuracy with delay circuit CMOS Voltage Detector

VDD Series

GENERAL DESCRIPTIONS

The VDD series are delay circuit built-in 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. Because the delay circuit is built-in, delay time can be set without any external components.

HALOGEN

RoHS COMPLIANCE

REACH COMPLIANCE

FEATURES

- Detection voltage range ..... 1.8V~6.0V (selectable with a step of 0.1V)
- Operating voltage range ..... 0.7V~6.0V
- High accuracy detection voltage ..... ±1% (V_{DET}=1.8V~6.0V)
- Detection voltage temperature characteristics ..... Typ. ±20ppm/°C (V_{DET}=1.8V~6.0V)
- Delay time ..... S/10~50ms, M/50~200ms, L/80~400ms
- Output types ..... CMOS or N-channel open drain
- Low current consumption ..... Typ. 0.6μA (V_{IN}=1.5V)
- Operating temperature range ..... –40°C ~ +85°C
- Small package ..... SOT-23 (2.9×2.8×1.1mm)

APPLICATIONS

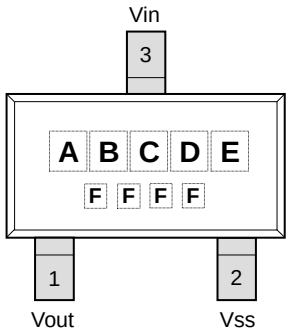
- Reset of microprocessor
- Power-on reset of system
- Charge detection of battery
- Battery back-up of memory
- Monitoring of battery life time
- Delay circuit

PRODUCTS NUMBERING GUIDE

VDD□□□□□□□

Design version	A : T_{OPR} = –40°C ~ +85°C
Package form	T : SOT-23
Output type	C : CMOS output N : N-channel open drain output
Delay time	S : 10msec~50msec M : 50msec~200msec L : 80msec~400msec
Detection accuracy rate	1 : ±1%
Detection voltage	18 ~ 60 : Selectable with a step of 0.1V in the range of 1.8V ~ 6.0V e.g.) 18 : 1.8V 30 : 3.0V

PIN CONFIGURATION / MARKING SPECIFICATION (SOT-23)



(Top view)

- **Pin Configuration**

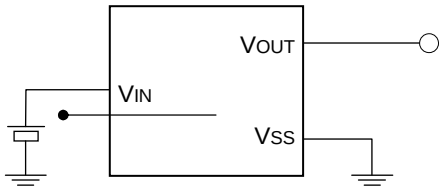
No.	Symbol	Descriptions
1	V_{OUT}	Output
2	V_{SS}	Power ground
3	V_{IN}	Voltage input

- **Marking Specification**

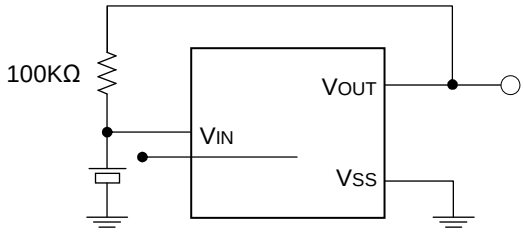
Code	Mark	Contents
A	C or N	Output type
BC	18~60	Detection voltage
D	S, M or L	Delay time
E	A	Version
F	Internal rule	Lot number

TYPICAL APPLICATION CIRCUITS

- **CMOS output**

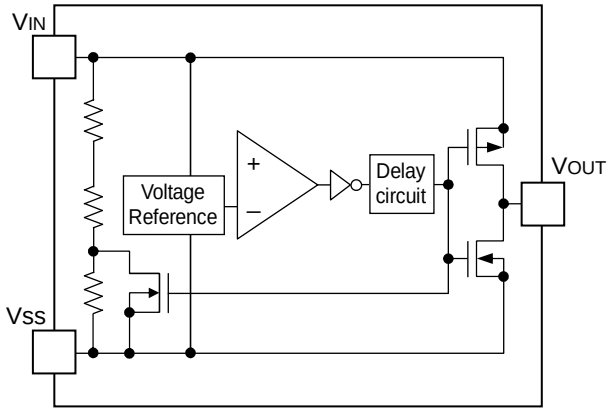


- **N-channel open drain output**

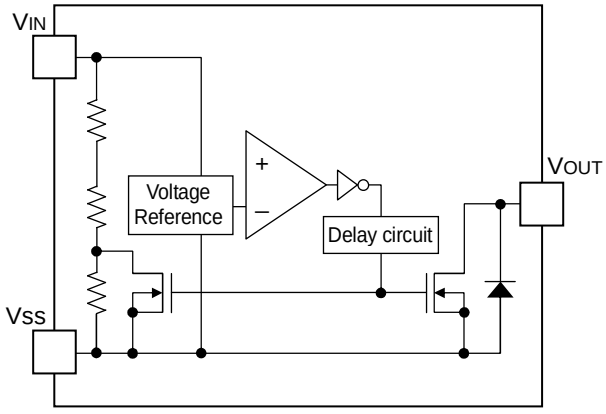


BLOCK DIAGRAM

- **CMOS output**



- **N-channel open drain output**



ABSOLUTE MAXIMUM RATINGS

Items		Symbol	Ratings	Unit
Input voltage range		V_{IN}	–0.3 ~ +7.0	V
Output current		I_{OUT}	50	mA
Output voltage range		V_{OUT}	V_{SS} –0.3 ~ V_{IN} +0.3	V
Power dissipation ※1)	SOT-23	P_D	400	mW
Operating temperature range		T_{OPR}	–40 ~ +85	°C
Storage temperature range		T_{STG}	–55 ~ +125	°C

Note :

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

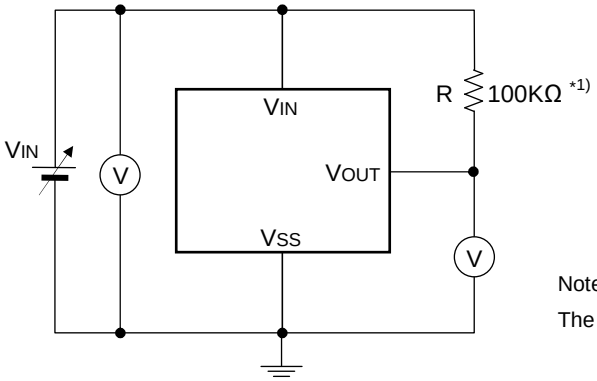
ELECTRICAL CHARACTERISTICS

(Ta=25°C unless otherwise specified)

Items	Symbol	Conditions		Min.	Typ.	Max.	Unit	Test circuit
Operating voltage	V_{IN}	V_{DET} = 1.8V ~ 6.0V		0.7	-	6.0	V	1
Detection voltage	V_{DET}	V_{DET} = 1.8V ~ 6.0V Ta = –40°C ~ +85°C		V_{DET} ×0.99	V_{DET}	V_{DET} ×1.01	V	1
Hysteresis range	V_{HYS}			V_{DET} ×0.02	V_{DET} ×0.05	V_{DET} ×0.08	V	1
Output current	I_{OUT}	N-ch V_{DS}=0.5V	V_{IN}=0.7V	0.1	0.4	-	mA	3
			V_{IN}=1.0V	1.0	2.3	-	mA	
			V_{IN}=2.0V	3.0	8.2	-	mA	
			V_{IN}=3.0V	5.0	11.1	-	mA	
			V_{IN}=4.0V	6.0	12.8	-	mA	
			V_{IN}=5.0V	7.0	13.8	-	mA	
		CMOS P-ch V_{DS}=2.1V	V_{IN}=6.0V	-	-9.5	-1.5	mA	4
		CMOS N-ch V_{DS}=2.1V	V_{IN}=6.0V	1.5	9.5	-	mA	3
Current consumption	I_{SS}		V_{IN}=1.5V	-	0.6	2.1	μA	2
			V_{IN}=2.0V	-	0.7	2.5	μA	
			V_{IN}=3.0V	-	0.8	2.8	μA	
			V_{IN}=4.0V	-	0.9	3.0	μA	
			V_{IN}=5.0V	-	1.0	3.4	μA	
Leak current	I_{LEAK}	V_{IN}=6.0V V_{OUT}=6.0V		-	10	100	nA	3
Detection voltage temperature coefficient	ΔV_{DET} / $\Delta Ta \cdot V_{DET}$	V_{DET} = 1.8V ~ 6.0V Ta = –40°C ~ +85°C		-	±20	-	ppm/°C	1
Delay time $V_{REL} \rightarrow V_{OUT}$ inversion	T_{DLY}	V_{IN} = 0.7V ~ 6.0V		10	-	50	ms	5
				50	-	200	ms	
				80	-	400	ms	

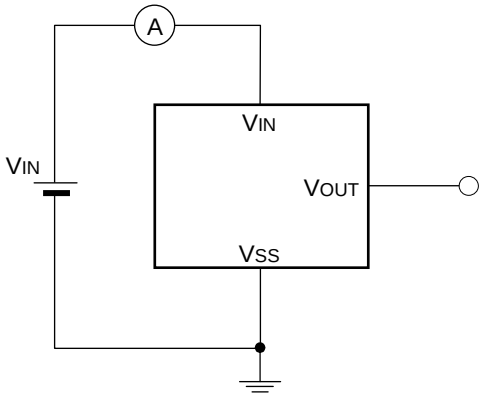
TEST CIRCUITS

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

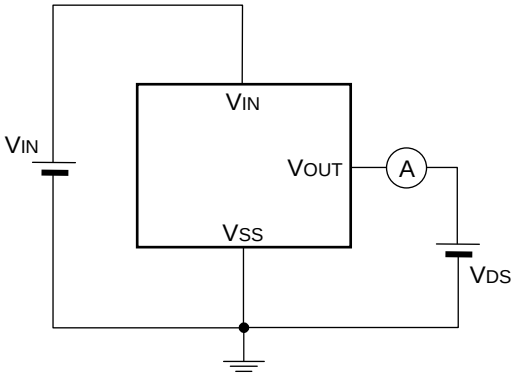


Note 1) :
The resistor (100KΩ) is not necessary for CMOS output products.

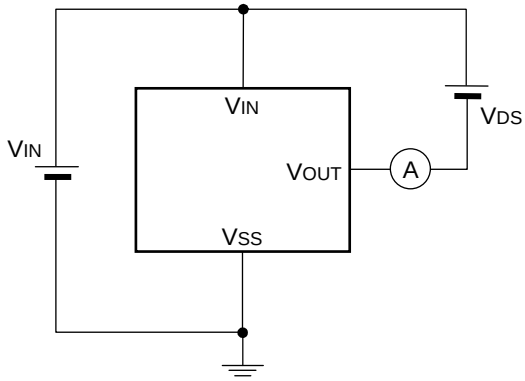
- **Circuit (2)** – Current consumption



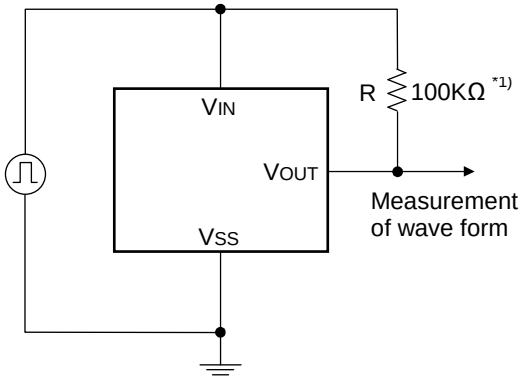
- **Circuit (3)** – N-ch driver output current



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



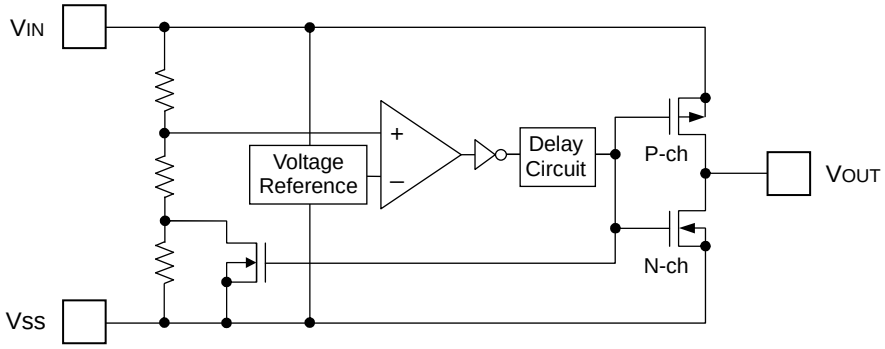
- **Circuit (5)** – Delay time (V_{REL}→V_{OUT} inversion)



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 VDD series ;



A. When the input voltage (VIN) is higher than the release voltage (VREL), the input voltage (VIN) 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 (VDET).

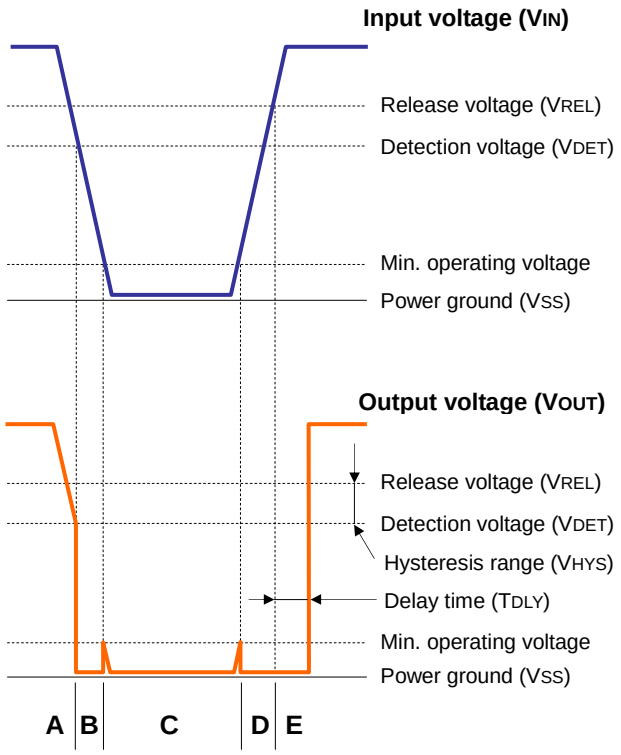
B. When the input voltage (VIN) falls below the detection voltage (VDET), the N-ch transistor is ON and the P-ch transistor is OFF. And, the output voltage (VOUT) is same as ground level (VSS).

C. When the input voltage (VIN) falls below the min. operating voltage, the output becomes unstable, or goes to VIN when the output is pulled up to VIN.

D. When the input voltage (VIN) rises above the minimum voltage, the ground voltage (VSS) level is maintained even though the input voltage (VIN) rises above the detection voltage (VDET) as long as it does not exceed the release voltage (VREL) level.

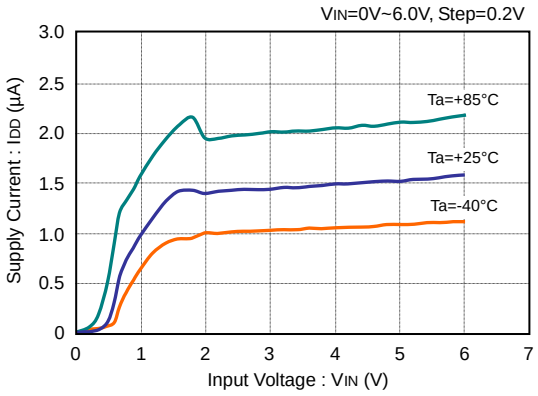
E. Following delay time, the N-ch transistor becomes OFF when the input voltage (VIN) rises above the release voltage (VREL), and the P-Ch transistor becomes ON. And, the output voltage (VOUT) is equal to input voltage (VIN). This difference between VDET and VREL is hysteresis range (VHYS).

[TIMING CHART]

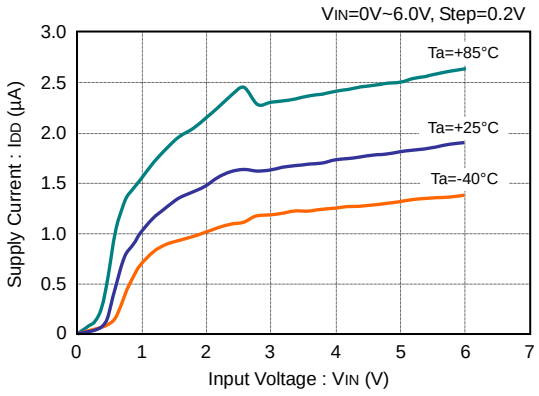


TYPICAL CHARACTERISTICS – Supply Current vs. Input Voltage

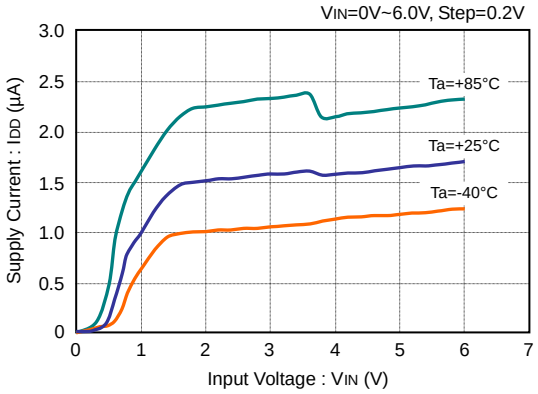
- **VDD181SCTA (CMOS 1.8V)**



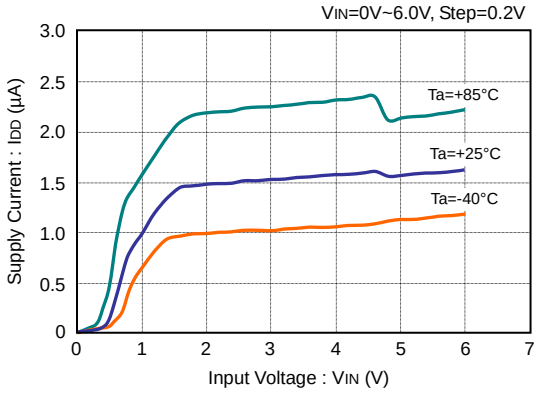
- **VDD251SCTA (CMOS 2.5V)**



- **VDD351SCTA (CMOS 3.5V)**

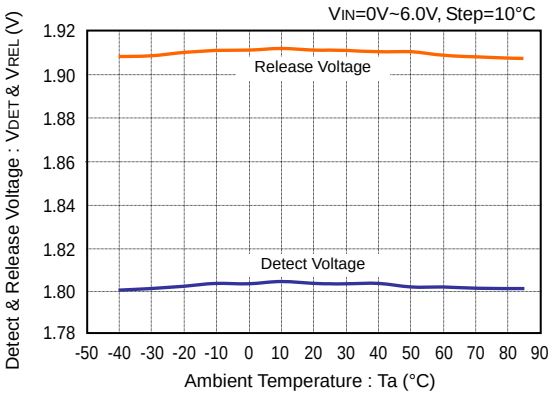


- **VDD451SCTA (CMOS 4.5V)**

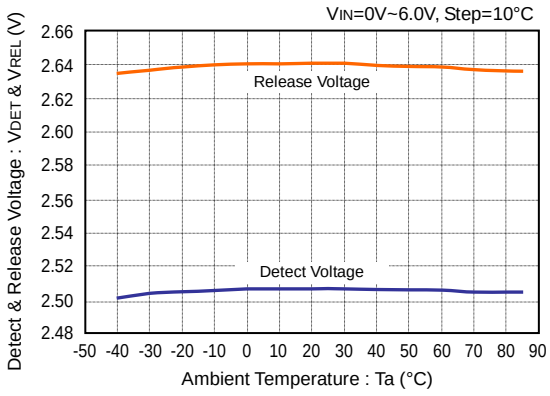


TYPICAL CHARACTERISTICS – Detect & Release Voltage vs. Ambient Temperature

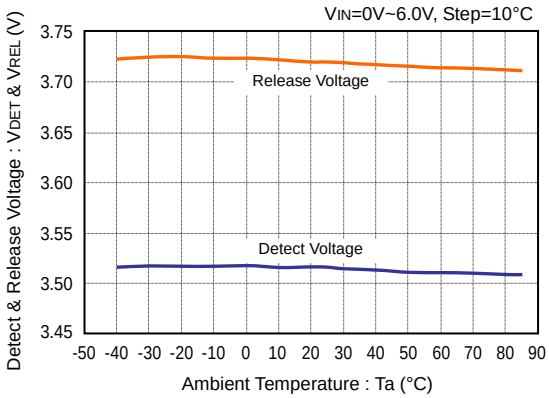
- **VDD181SCTA (CMOS 1.8V)**



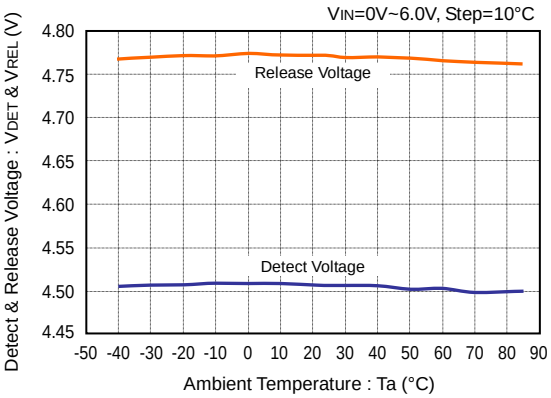
- **VDD251SCTA (CMOS 2.5V)**



- **VDD351SCTA (CMOS 3.5V)**

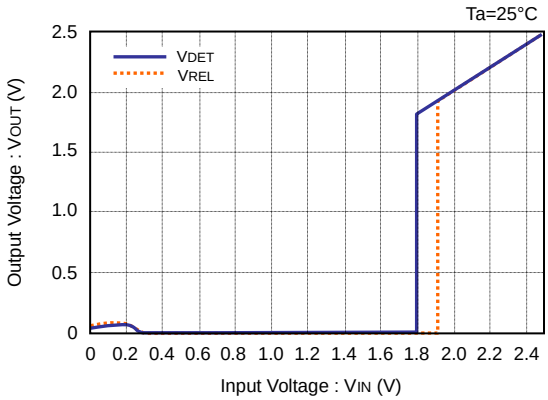


- **VDD451SCTA (CMOS 4.5V)**

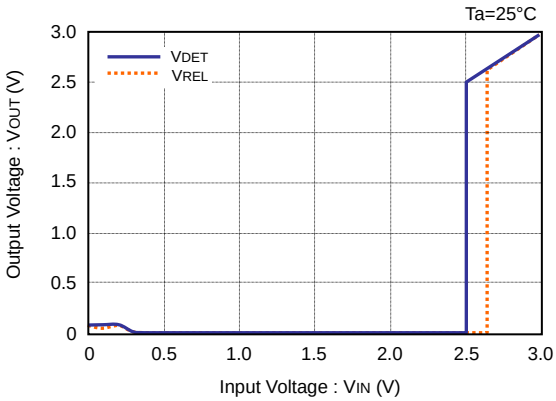


TYPICAL CHARACTERISTICS – Output Voltage vs. Input Voltage

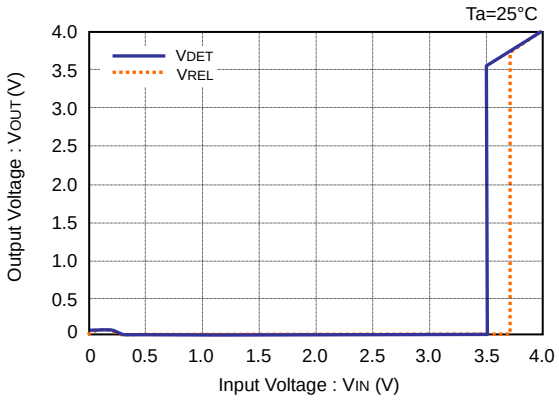
- **VDD181SCTA (CMOS 1.8V)**



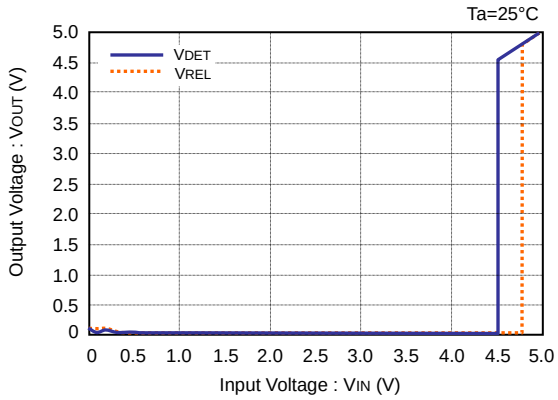
- **VDD251SCTA (CMOS 2.5V)**



- **VDD351SCTA (CMOS 3.5V)**

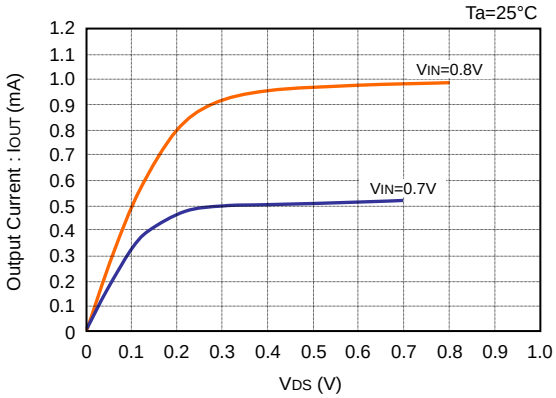


- **VDD451SCTA (CMOS 4.5V)**

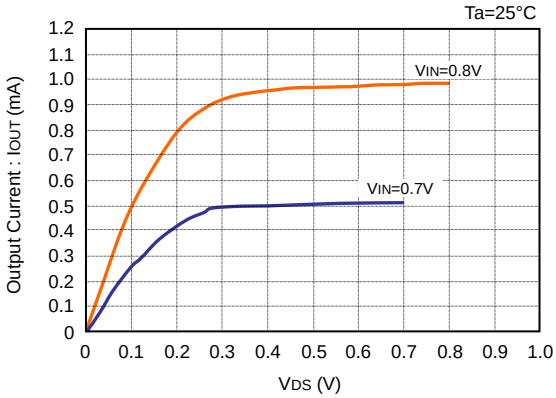


TYPICAL CHARACTERISTICS – N-ch Driver Output Current vs. V_{DS}

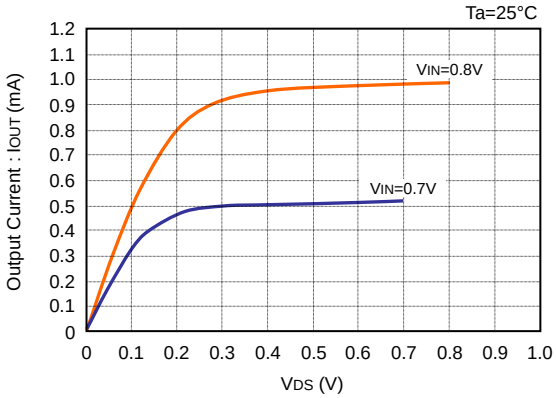
- **VDD181SCTA (CMOS 1.8V)**



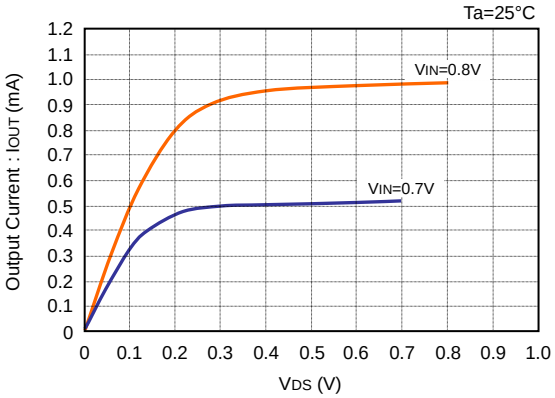
- **VDD251SCTA (CMOS 2.5V)**



- **VDD351SCTA (CMOS 3.5V)**

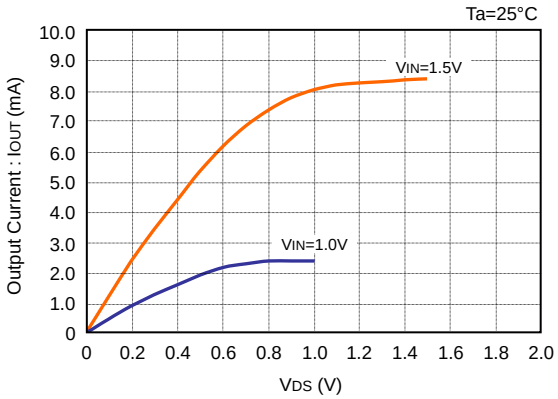


- **VDD451MCTA (CMOS 4.5V)**

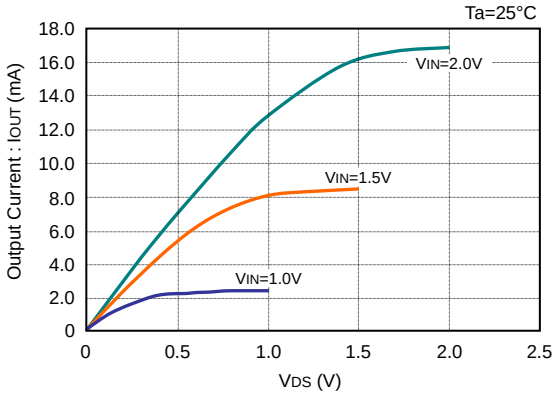


TYPICAL CHARACTERISTICS – N-ch Driver Output Current vs. V_{DS} (continued)

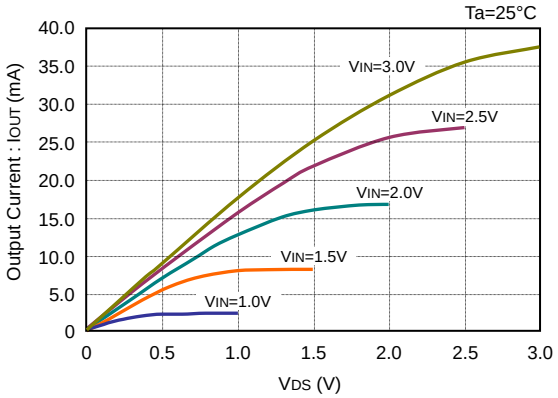
- **VDD181SCTA (CMOS 1.8V)**



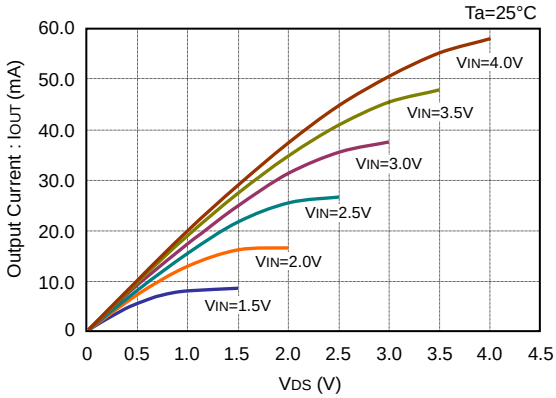
- **VDD251SCTA (CMOS 2.5V)**



- **VDD351SCTA (CMOS 3.5V)**

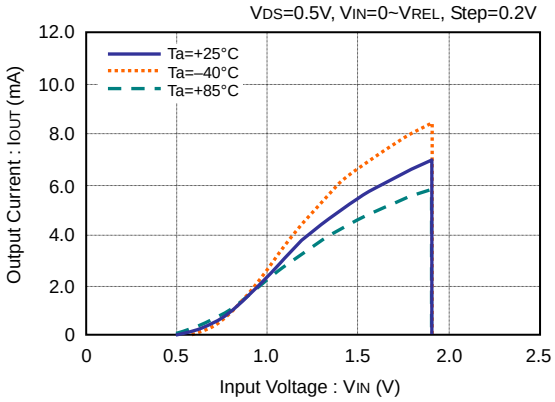


- **VDD451MCTA (CMOS 4.5V)**

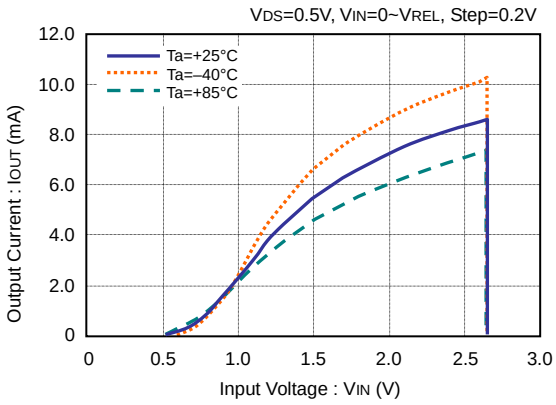


TYPICAL CHARACTERISTICS – N-ch Driver Output Current vs. Input Voltage

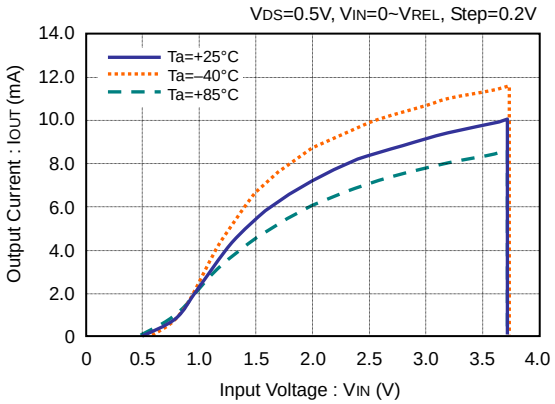
- **VDD181SCTA (CMOS 1.8V)**



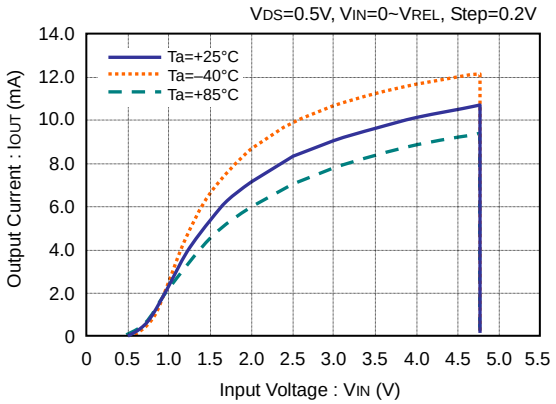
- **VDD251SCTA (CMOS 2.5V)**



- **VDD351SCTA (CMOS 3.5V)**

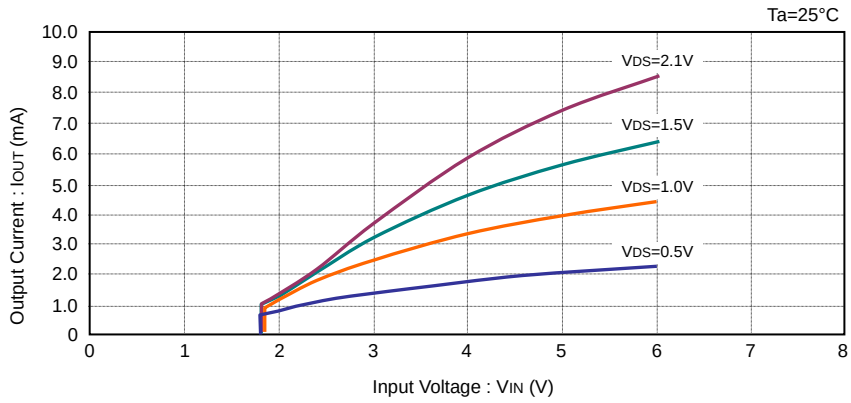


- **VDD451SCTA (CMOS 4.5V)**

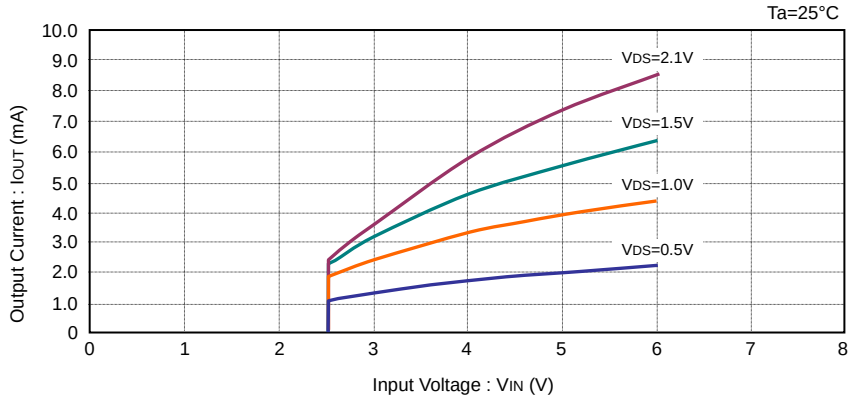


TYPICAL CHARACTERISTICS – P-ch Driver Output Current vs. Input Voltage

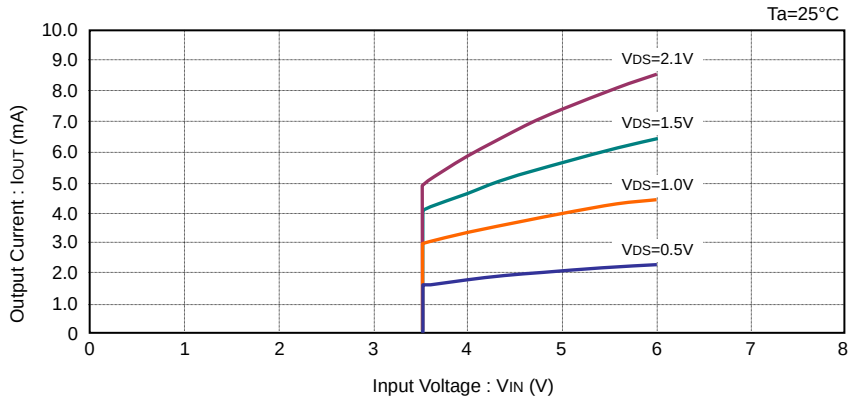
- **VDD181SCTA (CMOS 1.8V)**



- **VDD251SCTA (CMOS 2.5V)**

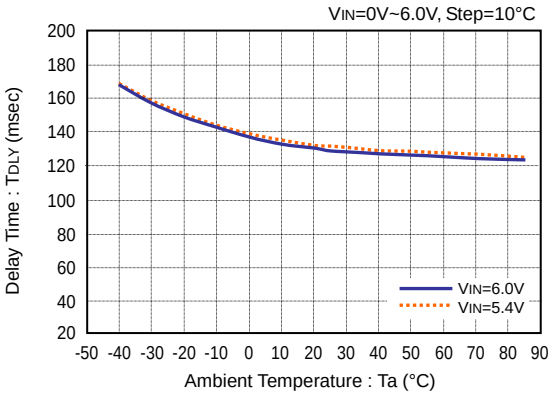


- **VDD351SCTA (CMOS 3.5V)**

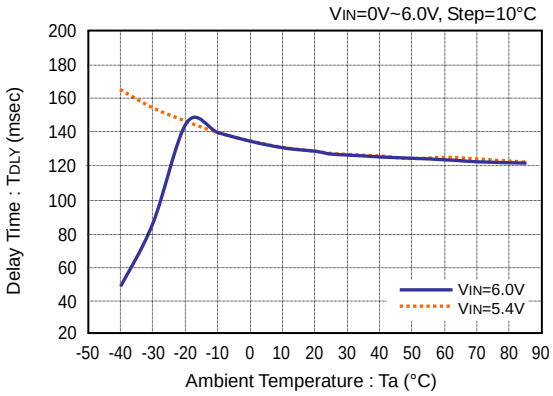


TYPICAL CHARACTERISTICS – Delay Time vs. Ambient Temperature

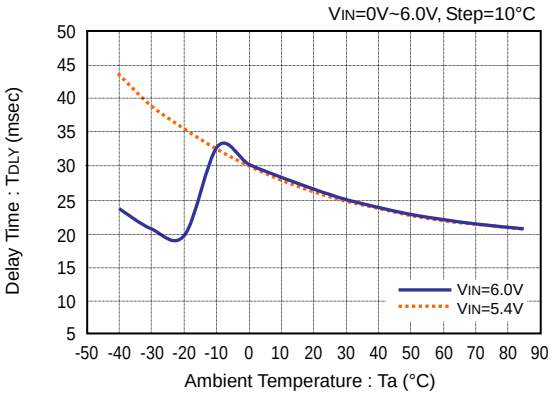
- **VDD221MCTA (CMOS 2.2V)**



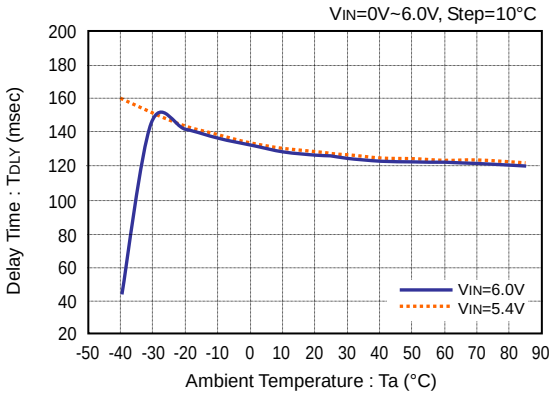
- **VDD271MCTA (CMOS 2.7V)**



- **VDD271SNTA (N-ch 2.7V)**

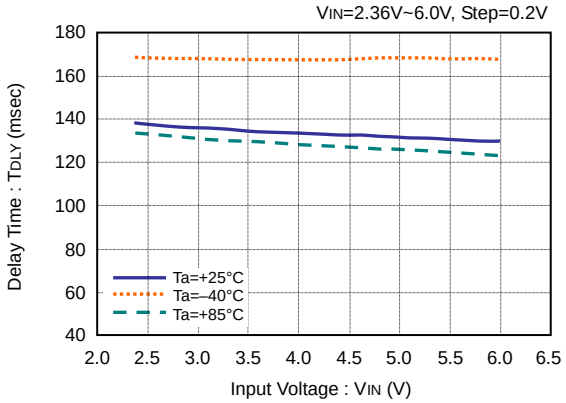


- **VDD301MCTA (CMOS 3.0V)**

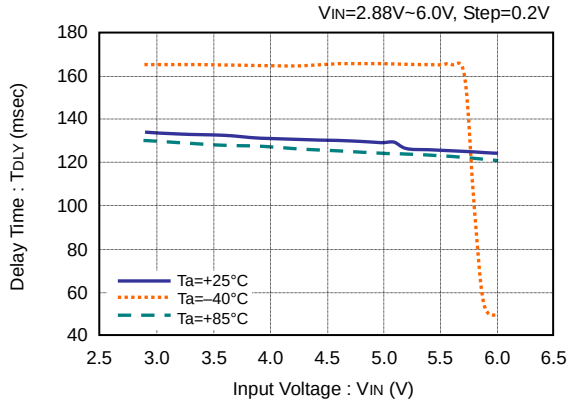


TYPICAL CHARACTERISTICS – Delay Time vs. Input Voltage

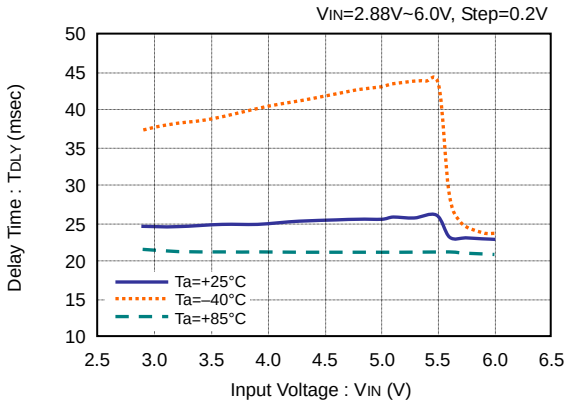
- **VDD221MCTA (CMOS 2.2V)**



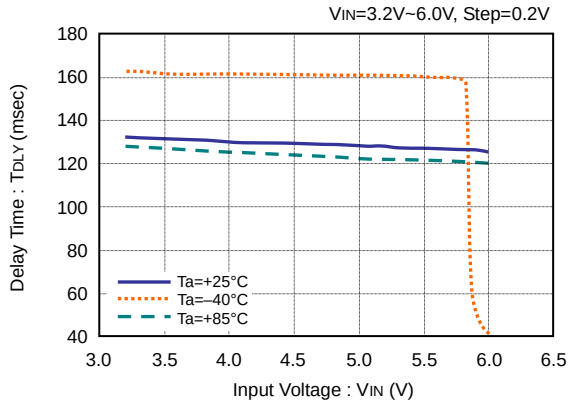
- **VDD271MCTA (CMOS 2.7V)**



- **VDD271SNTA (N-ch 2.7V)**

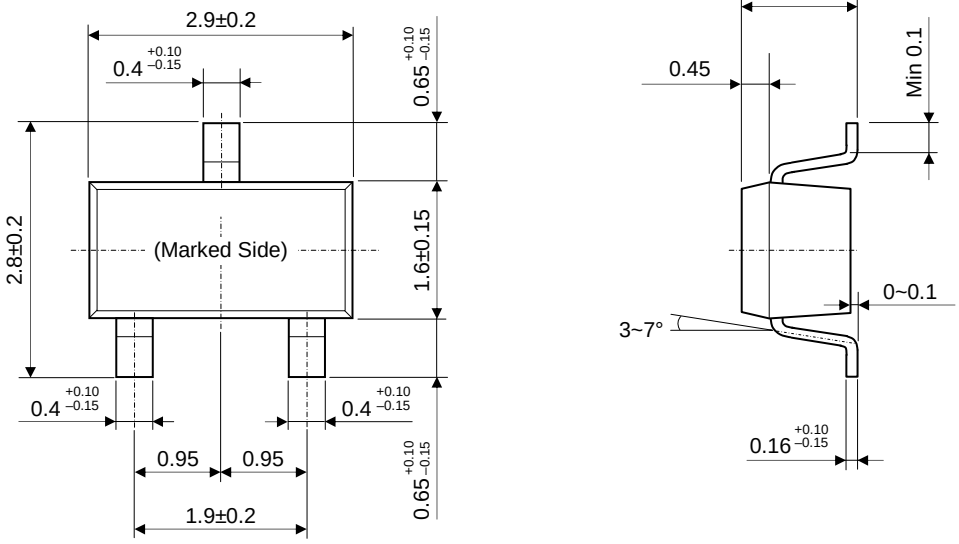


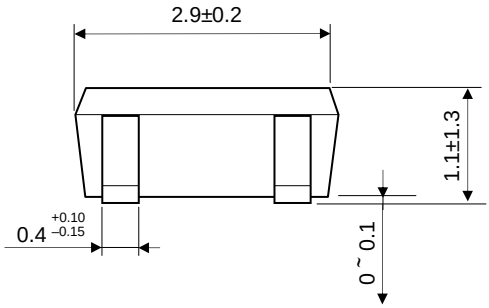
- **VDD301MCTA (CMOS 3.0V)**

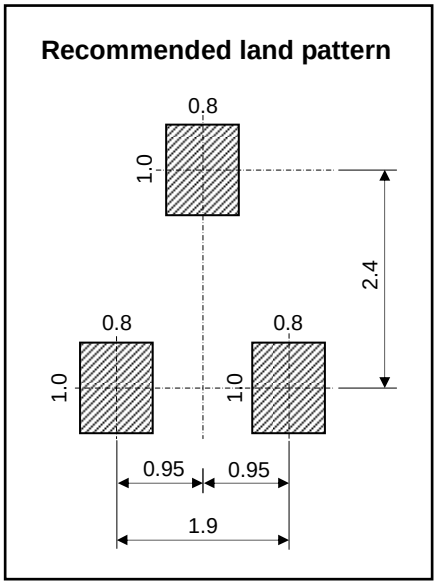


PACKAGE DIMENSIONS (SOT-23)

(Unit : mm)

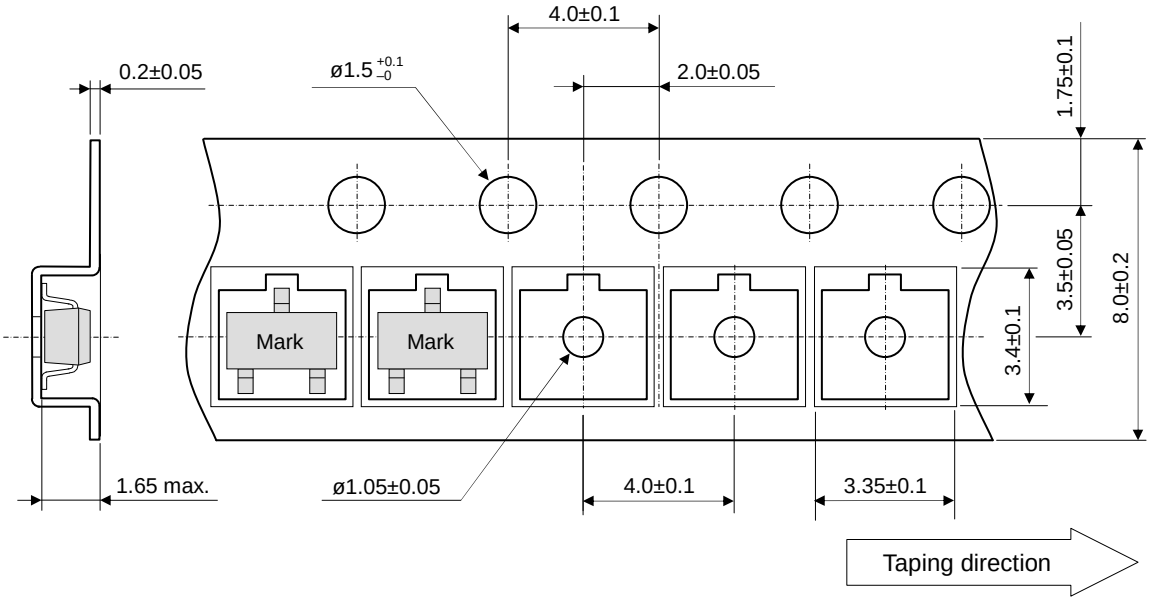






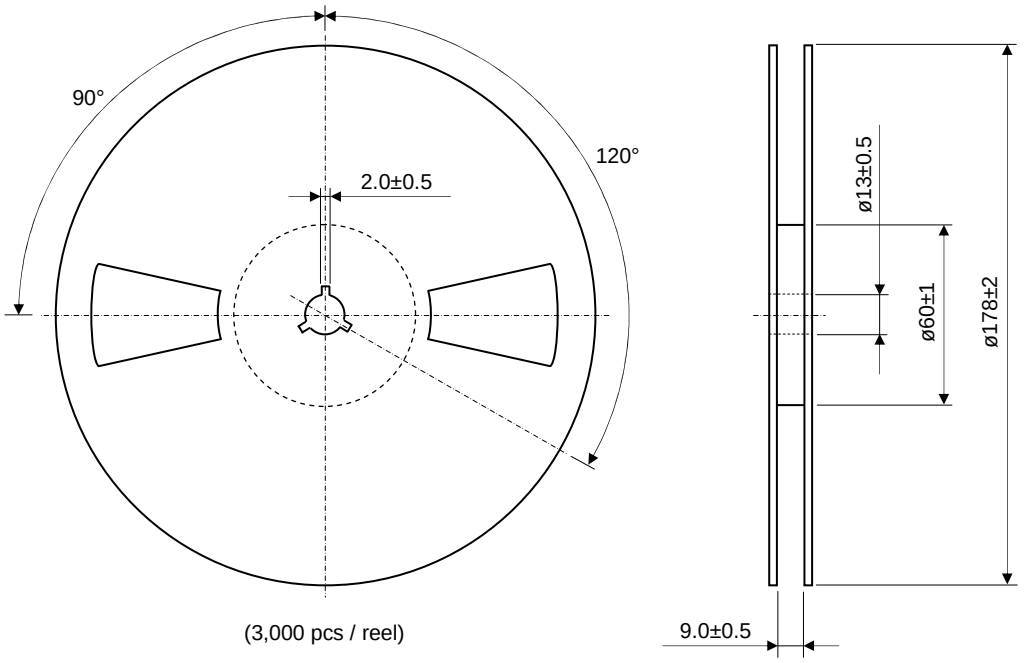
TAPING AND LOADING SPECIFICATIONS (SOT-23)

(Unit : mm)



REEL DIMENSIONS (SOT-23)

(Unit : mm)



(3,000 pcs / reel)

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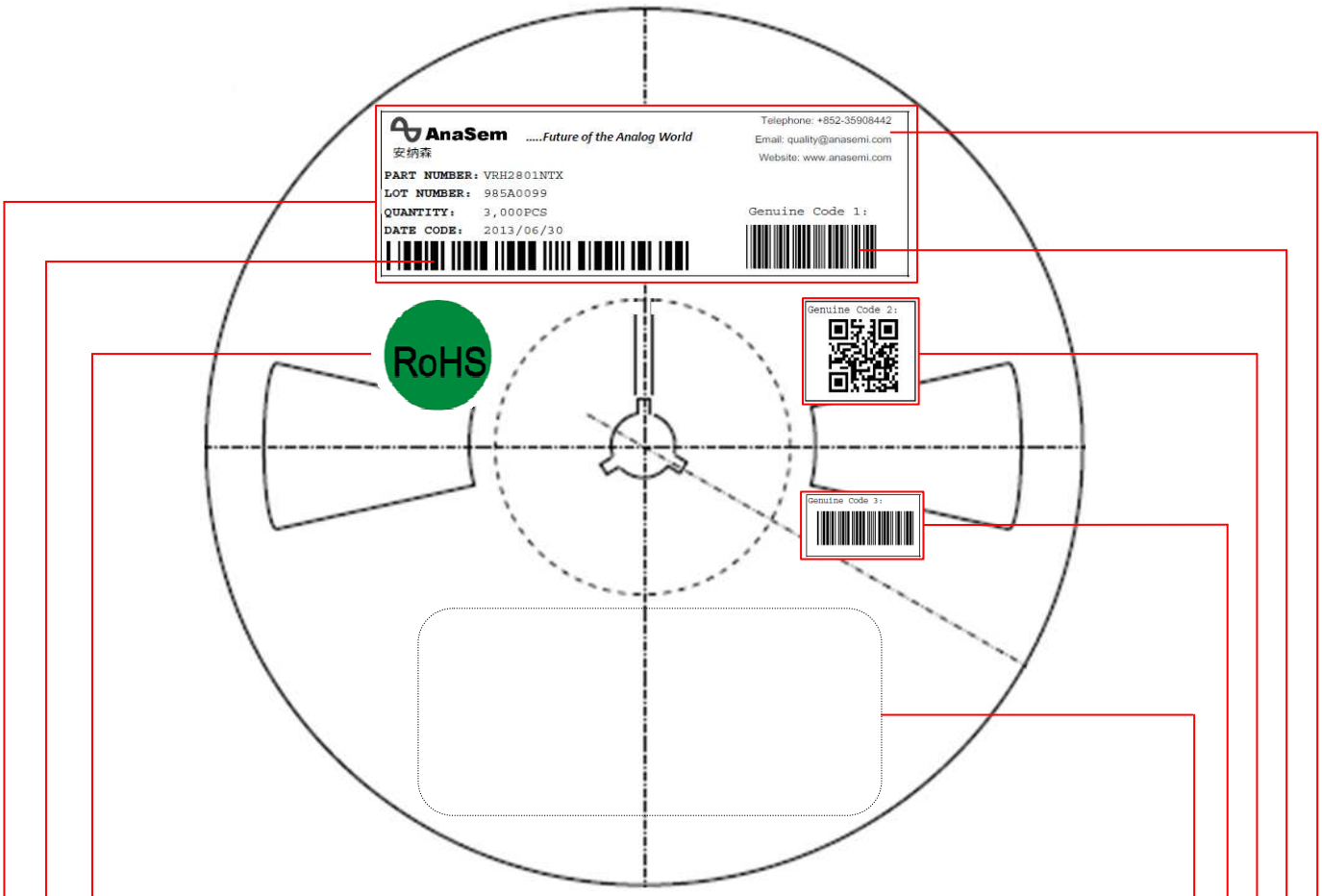
GENUINE PRODUCT LEGITIMATE LABEL DEFINITION



Green colored Circle “RoHS” Label

Ordinary Product Information Bar Code

AnaSem Logo and Brand Name (Black color Logo)

Other specific customized Labels

Our internal Outgoing Check Code 3

Our Internal QR Check Code 2

Our Internal Product Check Code 1

Genuine labels MUST include our correct contact information as shown