Nisshinbo Micro Devices Inc.

NV3600

CMOS Output
Voltage Detector with High Withstand of SENSE Pin

FEATURES

- Input Voltage Range (Maximum Rating): 2.4 V to 6.0 V (7.0 V)
- SENSE Pin Voltage Range (Maximum Rating): 0 V to 42.0 V (50.0 V)
- Operating Temperature Range: -40 °C to 105 °C
- Quiescent Current: Typ. 1.4 μA (VDD pin only) Max. 4.0 μA (Includes SENSE pin current)
- Detection Voltage: 3.3 V to 19.8 V (0.1 V increment)
  Accuracy: ±0.6 % (T_a = 25 °C) ±1.5 % (-40 °C to 105 °C)
- Release Voltage: 4.5 V to 22.2 V (0.1 V increment)
  Accuracy: ±0.6 % (T_a = 25 °C) ±1.5 % (-40 °C to 105 °C)
- Detection Delay Time: Typ. 40 μs
- Release Delay Time: Typ. 40 μs
- Output Type: NMOS Open Drain or CMOS

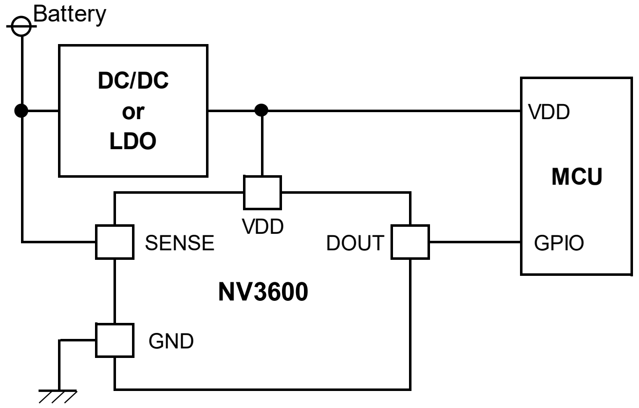
GENERAL DESCRIPTION

The NV3600 is using a CMOS based voltage detector. The high withstand voltage of 42 V at the SENSE pin allows this device to directly monitor battery voltage. NMOS open drain output type or CMOS output type can be selected for the output type.
Therefore, external voltage divider resistors and pull-up resistors are no longer required, reducing the number of external components and the dark current of the system.
In addition, the detection voltage and release voltage can be set separately, and the output logic at detection can also be selected to "Low" or "High".
Therefore, the optimum operation can be realized according to the system.

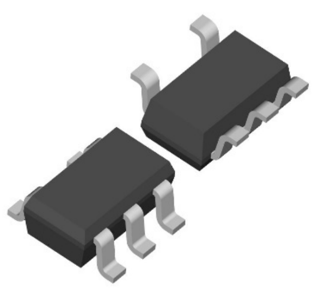
APPLICATIONS

- Power supply voltage supervisor in Factory Automation Equipment.
- Voltage supervisor in control devices like a PLCs.
- Power supply voltage supervisor in battery using devices like a mobile device.

TYPICAL APPLICATION CIRCUIT



PACKAGE



SOT-23-5-DC
2.9 × 2.8 × 1.1
(UNIT:mm)

PRODUCT NAME INFORMATION

NV3600 aa bbb c dd e

Description of configuration

Composition	Item	Description
aa	Package Code	DC: SOT-23-5-DC
bbb	Setting Voltage	Set detection voltage (V_{DET}) and release voltage (V_{REL}) The detection voltage can be set between 3.3 V to 19.8 V (0.1 V increment), The release voltage can be set between 4.5 V to 22.2 V (0.1 V increment). Hysteresis is 5 % or more (release voltage/detection voltage ≥ 1.05) is recommended.
c	Version	Output type (NMOS open drain or CMOS) and Output Logic at Detection ("Low" or "High").
dd	Packing	Insert direction. Refer to the packing specifications.
e	Grade	Indicates the quality grade. S: Consumer

Version

c	Output Type	Output Logic at Detection
A	NMOS open drain	Low
C	NMOS open drain	High
E	CMOS	Low
G	CMOS	High

Grade

e	Applications	Operating Temperature Range	Test Temperature
S	General-purpose and Consumer application	-40 °C to 105 °C	25 °C

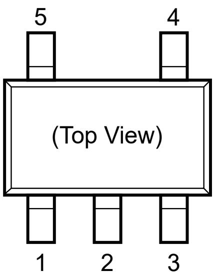
ORDER INFORMATION

PRODUCT NAME	PACKAGE	RoHS	HALOGEN-FREE	PLATING COMPOSITION	WEIGHT (mg)	QUANTITY PER REEL (pcs/reel)
NV3600 DC bbb c E1 S	SOT-23-5-DC	Yes	Yes	Sn	14.0	3000

Click here for checking details.

Note: Contact our sales representatives for other voltages.

PIN DESCRIPTIONS

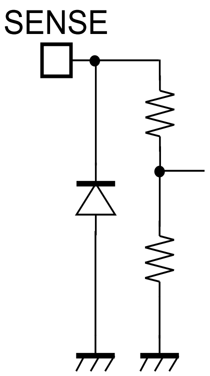


SOT-23-5-DC Pin Configuration

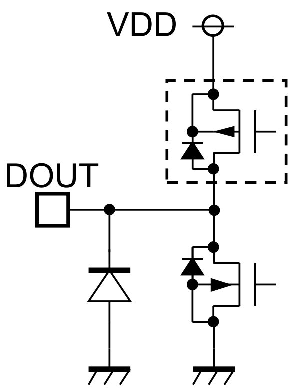
Pin No.	Pin Name	I/O	Description
1	SENSE	I	SENSE Voltage Input Pin
2	GND	-	Ground Pin
3	DOUT	O	Voltage Detection Output Pin NV3600DCxxxA/E: outputs "Low" reset signal when a voltage drops below the detection voltage. NV3600DCxxxC/G: outputs "High" reset signal when a voltage drops below the detection voltage. The "High" output level for CMOS output type is the VDD pin voltage.
4	NC	-	No Connection NC is electrically open. Please mount it on the board. However, it is recommended to make it electrically open to prevent short circuit with adjacent pins during mounting.
5	VDD	Power	Power Supply Input Pin

Please refer to "*TYPICAL APPLICATION CIRCUIT*" or "*THEORY OF OPERATION*" for details.

Internal Equivalent Circuit Diagram of Pin



SENSE pin internal equivalent circuit diagram



※Dotted frame corresponds to (NV3600DCxxxE/G)

DOUT pin internal equivalent circuit diagram

ABSOLUTE MAXIMUM RATINGS

	Symbol	Ratings	Unit
VDD Pin Voltage	V_{DD}	-0.3 to 7.0	V
SENSE Pin Voltage	V_{SENSE}	-0.3 to 50.0	V
DOUT Pin Voltage	V_{DOUT}	-0.3 to 7.0	V
DOUT Pin Output Current	I_{DOUT}	30	mA
Junction Temperature Range [*1]	T_j	-40 to 125	°C
Storage Temperature Range	T_{stg}	-55 to 125	°C

ABSOLUTE MAXIMUM RATINGS
Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause permanent damage and may degrade the lifetime and safety for both device and system using the device in the field. The functional operation at or over these absolute maximum ratings is not assured.

[*1] Calculate the power consumption of the IC from the operating conditions and calculate the junction temperature with the thermal resistance. Please refer to "*THERMAL CHARACTERISTICS*" for the thermal resistance under our measurement board conditions.

THERMAL CHARACTERISTICS

Parameter	Measurement Result	Unit
Thermal Resistance (θja)	150	°C/W
Thermal Characterization Parameter (ψjt)	51	

θja: Junction-to-Ambient Thermal Resistance
ψjt: Junction-to-Top Thermal Characterization Parameter
For more information, click *here*.

ELECTROSTATIC DISCHARGE RATINGS

	Conditions	Protection Voltage
HBM	C = 100 pF, R = 1.5 kΩ	±2000 V
CDM		±1000 V

ELECTROSTATIC DISCHARGE RATINGS

The electrostatic discharge test is done based on JESD47.
In the HBM method, ESD is applied using the power supply pin and GND pin as reference pins.

RECOMMENDED OPERATING CONDITIONS

	Symbol	Ratings	Unit
VDD Pin Voltage	V_{DD}	2.4 to 6.0	V
SENSE Pin Voltage	V_{SENSE}	0 to 42.0	V
DOUT Pin Pull-up Voltage (NV3600DCxxxA/C)	V_{UP}	0 to 6.0	V
Operating Temperature Range	T_a	-40 to 105	°C

RECOMMENDED OPERATING CONDITIONS

All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if they are used over such conditions by momentary electronic noise or surge. And the semiconductor devices may receive serious damage when they continue to operate over the recommended operating conditions.

ELECTRICAL CHARACTERISTICS

V_{DD} = 6 V unless otherwise specified.
For NV3600DCxxxA/C (NMOS Open Drain Type), pull-up resistor (R_{UP}) = 100 kΩ, pull-up voltage (V_{UP}) = 5 V
For parameter that do not describe the temperature condition, the MIN/MAX value under the condition of -40 °C ≤ Ta ≤ 105 °C is described.

Parameter	Symbol	Conditions		MIN	TYP	MAX	Unit
Detection Voltage	V_{DET}	V_{SENSE} = Falling	T_a = 25 °C	×0.994	-	×1.006	V
			-40 °C ≤ T_a ≤ 105 °C	×0.985	-	×1.015	V
Release Voltage	V_{REL}	V_{SENSE} = Rising	T_a = 25 °C	×0.994	-	×1.006	V
			-40 °C ≤ T_a ≤ 105 °C	×0.985	-	×1.015	V
Quiescent Current [*1]	I_Q	V_{SENSE} = V_{REL} +1 V		-	1.4	2.7	μA
SENSE Pin Current	I_{SENSE}	V_{SENSE} = 12 V		0.2	-	1.3	μA
UVLO Detection Voltage [2]	$V_{UVLODET}$	V_{DD} = Falling		2.1	-	2.3	V
UVLO Release Voltage [*2]	$V_{UVLOREL}$	V_{DD} = Rising		2.2	-	2.4	V
DOUT Pin Minimum Operating Voltage [*3]	V_{DDL}			-	-	1.7	V
DOUT Pin Output Current	I_{DOUT}	DOUT = "High", V_{DD} = 2.4 V (NV3600DCxxxE/G)	V_{DOUT} = V_{DD} - 0.1 V	0.10	-	-	mA
			V_{DOUT} = V_{DD} - 0.3 V	0.25	-	-	
		DOUT = "Low", V_{DD} = 2.4 V	V_{DOUT} = 0.1 V	0.40	-	-	mA
			V_{DOUT} = 0.3 V	1.00	-	-	
DOUT Pin Leakage Current [*4]	$I_{DOUTLEAK}$	V_{DOUT} = 6 V (NV3600DCxxxA/C)		-	-	0.3	μA
Detection Delay Time [*5]	t_{DET}	V_{DD} = 2.4 V		-	40	90	μs
Release Delay Time [*6]	t_{REL}	V_{DD} = 2.4 V		-	40	90	μs

All test items listed in Electrical Characteristics are done under the pulse load condition (T_j ≈ T_a = 25°C)

[*1] VDD pin current.
[*2] Due to circuit configuration, $V_{UVLODET}$ ≥ $V_{UVLOREL}$ does not hold. The hysteresis is Typ. 0.09 V.
[*3] This minimum VDD voltage to prevent DOUT pin output from becoming indefinite.
Judgment conditions are as follows.
NV3600DCxxxA/E ("Low" output at detection): V_{DOUT} ≤ 0.1 V
NV3600DCxxxC ("High" output at detection, NMOS open drain): V_{DOUT} ≥ V_{UP} - 0.1 V
NV3600DCxxxG ("High" output at detection, CMOS): V_{DOUT} ≥ V_{DD} - 0.1 V
[*4] Leakage current when the NMOS output transistor is OFF.
[*5] For detailed conditions of the detection delay time, refer to "*Detection Delay Time*".
[*6] For detailed conditions of the release delay time, refer to "*Release Delay Time*".

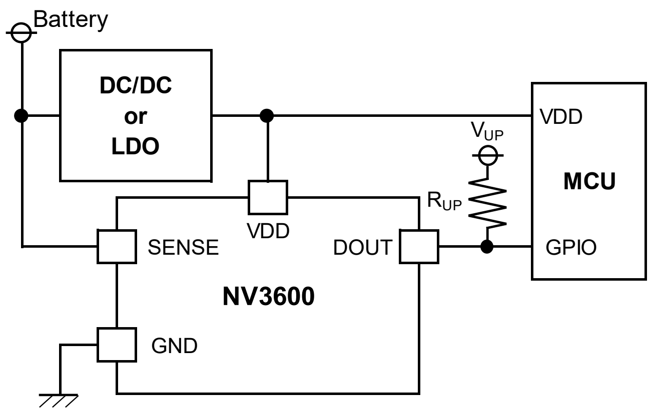
ELECTRICAL CHARACTERISTICS

[Unit: V]

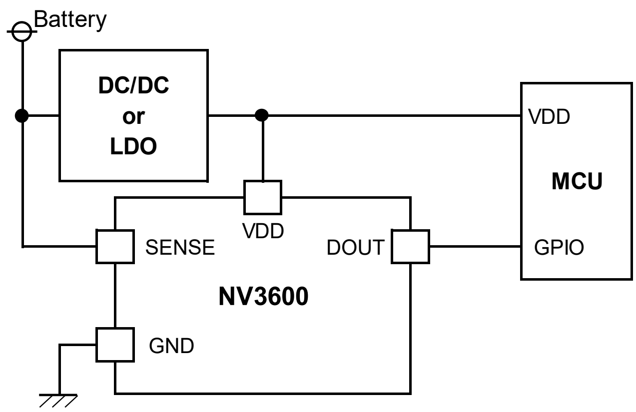
PRODUCT NAME	V_{DET}					V_{REL}				
	T_a = 25 °C			-40 °C ≤ T_a ≤ 105 °C		T_a = 25 °C			-40 °C ≤ T_a ≤ 105 °C	
	MIN	TYP	MAX	MIN	MAX	MIN	TYP	MAX	MIN	MAX
NV3600DC001 xxxx	3.280	3.3	3.320	3.250	3.350	4.473	4.5	4.527	4.432	4.568
NV3600DC002 xxxx	19.681	19.8	19.919	19.503	20.097	22.066	22.2	22.334	21.867	22.533
NV3600DC003 xxxx	9.940	10.0	10.060	9.850	10.150	10.934	11.0	11.066	10.835	11.165
NV3600DC004 xxxx	5.069	5.1	5.131	5.023	5.177	7.554	7.6	7.646	7.486	7.714

All test items listed in Electrical Characteristics are done under the pulse load condition (T_j ≈ T_a = 25°C)

TYPICAL APPLICATION CIRCUIT



NV3600DCxxxA/C



NV3600DCxxxE/G

EXTERMAL COMPONENTS

Pull-up Resistor (R_{UP})

NV3600DCxxxA/C: DOUT pin voltage depends on the external pull-up resistor (R_{UP}).
Refer to the next formula and choose an appropriate value for the resistance.

(1) Lower limit of the pull-up resistor (R_{UP})
"Low" voltage level (V_{DOUTL}) of DOUT is determined by on resistance (R_{ON}) of NMOS output transistor, pull-up resistor (R_{UP}), and pull-up voltage (V_{UP}).

$$V_{DOUTL} = R_{ON} / (R_{ON} + R_{UP}) \times V_{UP}$$

The maximum value of R_{ON} can be calculated by the following with using the value of "DOUT pin Output Current" of Electrical Characteristics Table. ($V_{DOUTL} \leq 0.3$ V)

$$R_{ON} \text{ (MAX)} = 0.3 \text{ V} / 1 \text{ mA} = 0.3 \text{ k}\Omega$$

To obtain the desirable "Low" voltage level (V_{DOUTL}), the minimum value of R_{UP} should satisfy the next equation.

$$R_{UP} \geq (V_{UP} - V_{DOUTL}) / V_{DOUTL} \times R_{ON}$$

* If R_{UP} is small, the quiescent current under the condition of DOUT "Low" output ($\approx V_{UP}/R_{UP}$) may increase.
(The recommendation value of the pull-up resistor is 1 kΩ or more.)

(2) Higher limit of the pull-up resistor (R_{UP})
"High" voltage level (V_{DOUTH}) of DOUT is determined by DOUT pin leakage current ($I_{DOUTLEAK}$) and pull-up resistor (R_{UP}) and pull-up voltage (V_{UP}).

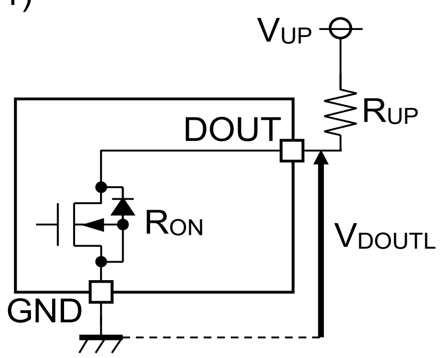
$$V_{DOUTH} = V_{UP} - I_{DOUTLEAK} \times R_{UP}$$

The maximum value of $I_{DOUTLEAK}$ is specified in the Electrical Characteristics Table. (= 0.3 µA)
To satisfy the desirable "High" voltage, the higher limit of R_{UP} should satisfy the next equation.

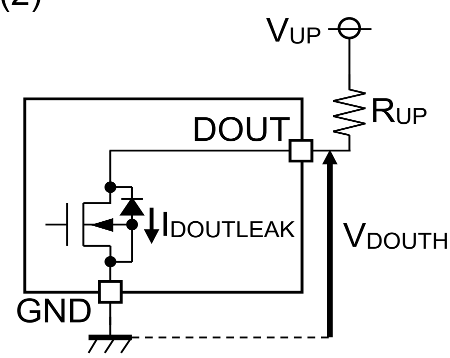
$$R_{UP} \leq (V_{UP} - V_{DOUTH}) / I_{DOUTLEAK}$$

(Ex.)
V_{UP} = 5 V, The target DOUT pin voltage "Low" = 0.3 V, "High" = 4.7 V
By the equation (1), $R_{UP} \geq (5 \text{ V} - 0.3 \text{ V}) / 0.3 \text{ V} \times 0.3 \text{ k}\Omega = 4.7 \text{ k}\Omega$
By the equation (2), $R_{UP} \leq (5 \text{ V} - 4.7 \text{ V}) / 0.3 \text{ µA} = 1 \text{ M}\Omega$
Therefore, appropriate value range of pull-up resistor is from 4.7 kΩ to 1 MΩ.

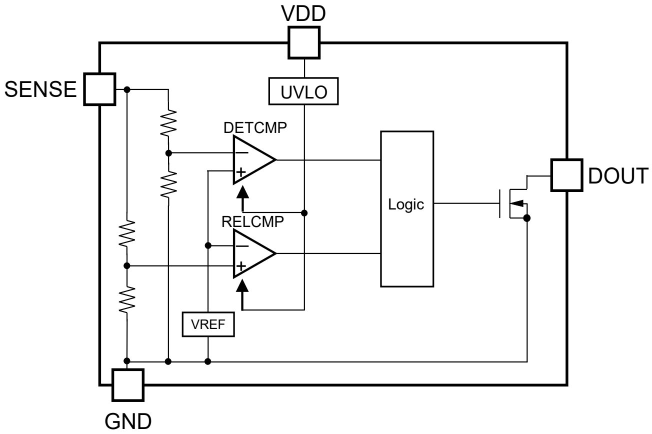
(1)



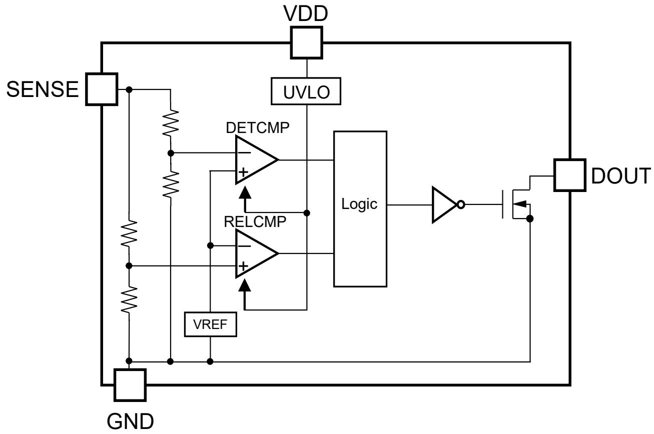
(2)



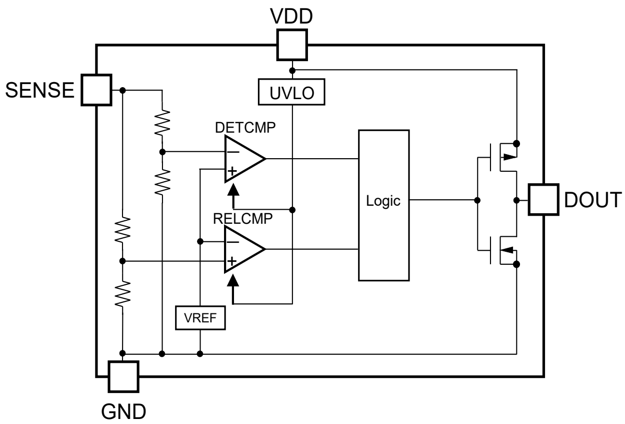
BLOCK DIAGRAMS



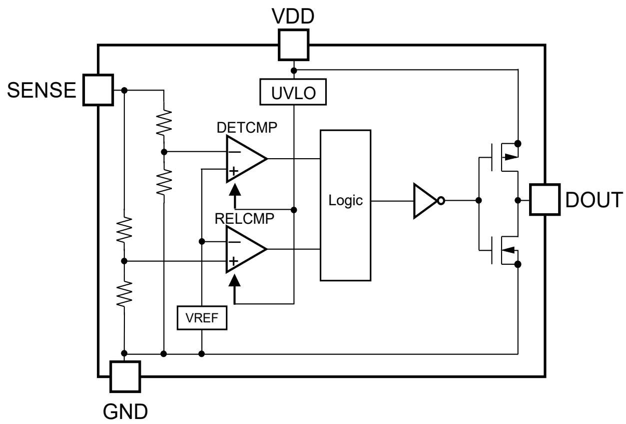
NV3600DCxxxA Block Diagram



NV3600DCxxxC Block Diagram



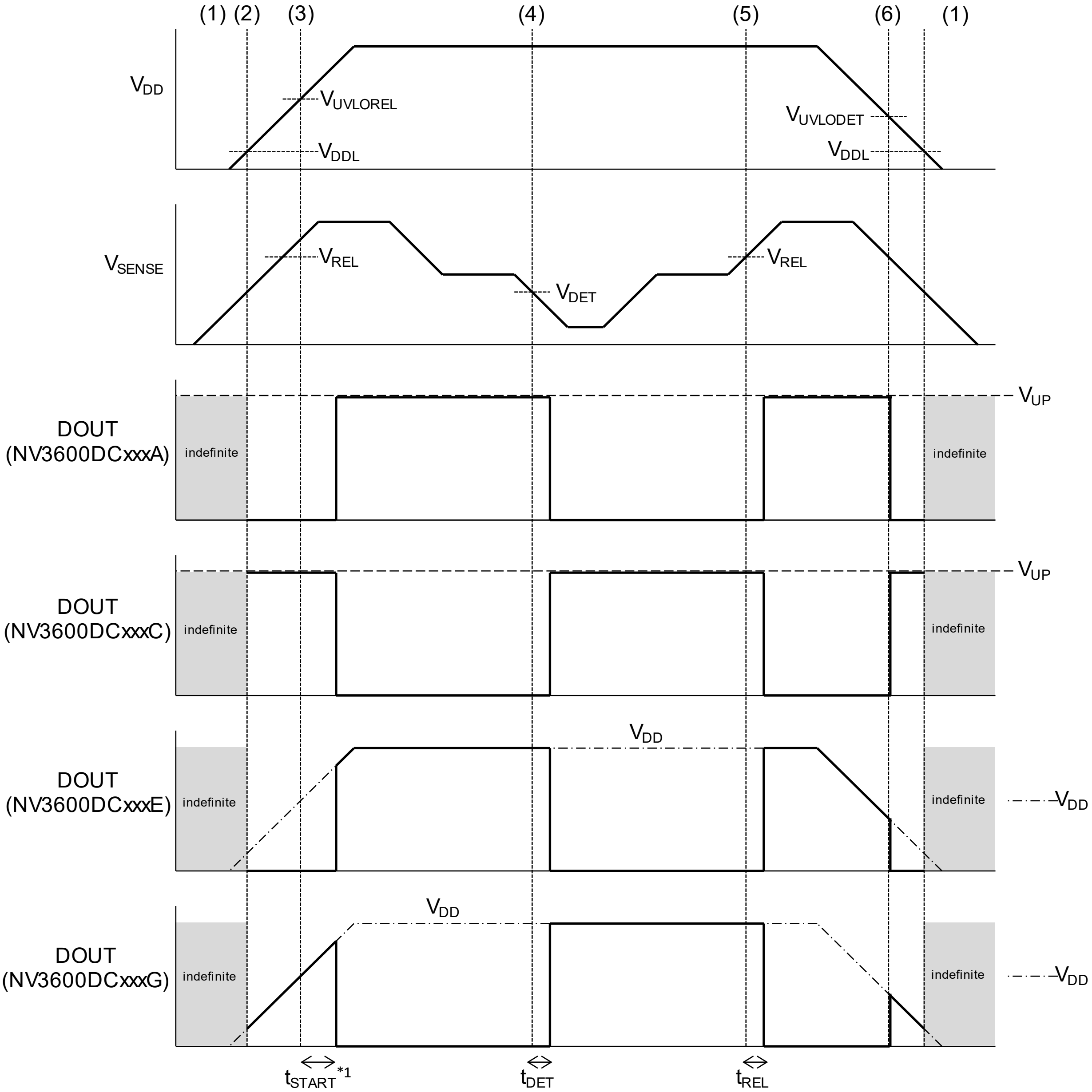
NV3600DCxxxE Block Diagram



NV3600DCxxxG Block Diagram

THEORY OF OPERATION

During VDD pin power-up, when V_{DD} exceeds the UVLO release voltage, if $V_{SENSE} \geq V_{REL}$.



(1) V_{DD} is equal or lower than DOUT pin minimum operating voltage (V_{DDL}), DOUT output is not guaranteed. "(Indefinite)"

(2) V_{DD} exceeds V_{DDL}, DOUT output asserts "detected condition".

(3) V_{DD} exceeds UVLO release voltage ($V_{UVLOREL}$), if SENSE pin voltage (V_{SENSE}) is equal or more than the release voltage (V_{REL}), after the start-up time[*1] (t_{START}: Max. 1 ms), DOUT output asserts "released condition". Even though V_{SENSE} falls, unless otherwise the voltage is less than the detection voltage (V_{DET}), "released condition" is maintained.

(4) Further V_{SENSE} falls and when it becomes equal or lower than V_{DET}, after the detection delay time (t_{DET}: Typ. 40 μs), DOUT output asserts "detected condition".

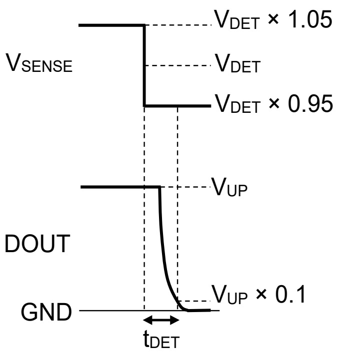
(5) V_{SENSE} rises and exceeds V_{REL}, after the release delay time (t_{REL}: Typ. 40 μs), DOUT output asserts "released condition".

(6) V_{DD} falls and when it becomes equal or lower than the UVLO detection voltage ($V_{UVLODET}$), DOUT output asserts "detected condition".

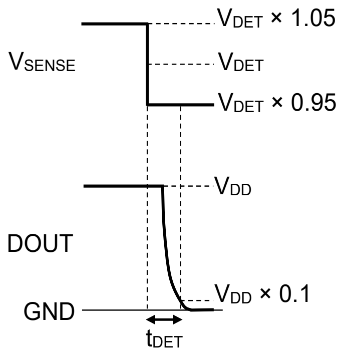
[*1] Start-up time (t_{START}) is the total time of UVLO release delay time and release delay time.

DETECTION DELAY TIME (t_{DET})

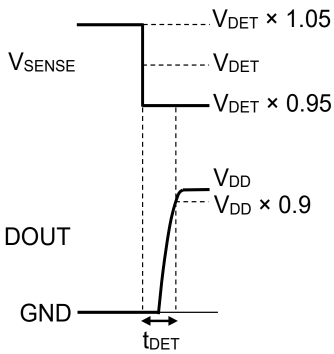
Detection delay time (t_{DET}) means the period from the falling edge of the pulse between V_{DET} × 1.05 and V_{DET} × 0.95 for SENSE pin to the designated conditions shown below.
NV3600DCxxxA: Until DOUT pin voltage reaches V_{UP} × 0.1. (V_{UP} is pull-up voltage of DOUT)
NV3600DCxxxE: Until DOUT pin voltage reaches V_{DD} × 0.1.
NV3600DCxxxG: Until DOUT pin voltage reaches V_{DD} × 0.9.
As for NV3600DCxxxC, the delay time may be longer than expected by the effect of the parasitic capacitance of PCB and pull-up resistor.



NV3600DCxxxA



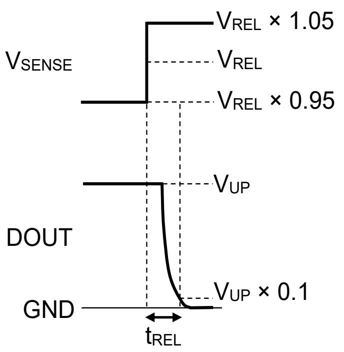
NV3600DCxxxE



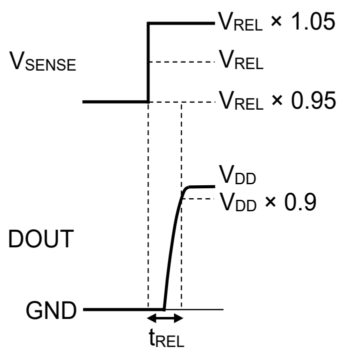
NV3600DCxxxG

RELEASE DELAY TIME (t_{REL})

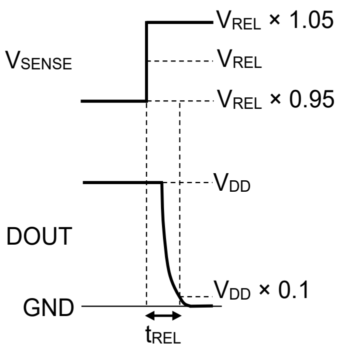
Release delay time (t_{REL}) is the period from when the rising edge of the pulse between V_{REL} × 0.95 and V_{REL} × 1.05 for SENSE pin to the designated conditions shown below.
NV3600DCxxxC: Until DOUT pin voltage reaches V_{UP} × 0.1. (V_{UP} is pull-up voltage of DOUT)
NV3600DCxxxE: Until DOUT pin voltage reaches V_{DD} × 0.9.
NV3600DCxxxG: Until DOUT pin voltage reaches V_{DD} × 0.1.
As for NV3600DCxxxA, the delay time may be longer than expected by the effect of the parasitic capacitance of PCB and pull-up resistor.



NV3600DCxxxC



NV3600DCxxxE



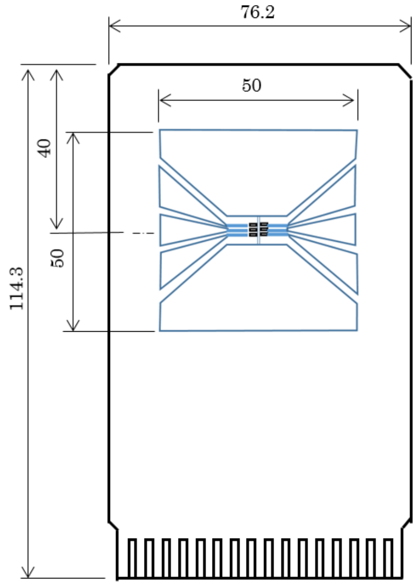
NV3600DCxxxG

THERMAL CHARACTERISTICS (SOT-23-DC)

Thermal characteristics depend on the mounting conditions. The following measurement conditions are based on JEDEC STD. 51.

Measurement Conditions

Parameter	Measurement Conditions
Measurement status	Mounting on Board (Wind Velocity = 0 m/s)
Board material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board size	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	Outer Layer (First Layer): Less than 95% of 50 mm Square Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square
Through hole	ϕ 0.3 mm × 7 pcs



Measurement Board Pattern

Measurement Result

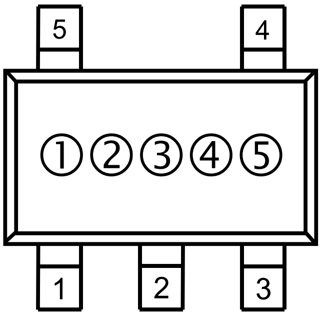
Parameter	Measurement Result
Thermal Resistance (θja)	θja = 150°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 51°C/W

θja: Junction-to-Ambient Thermal Resistance

ψjt: Junction-to-Top Thermal Characterization Parameter

MARKING SPECIFICATION

①②③ : Product Code (Abbreviation)
④⑤ : Lot Number ··· Alphanumeric Serial Number



SOT-23-5-DC Marking

NOTICE
There can be variation in the marking when different AOI (Automated Optical Inspection) equipment is used. In the case of recognizing the marking characteristic with AOI, please contact our sales or distributor before attempting to use AOI.

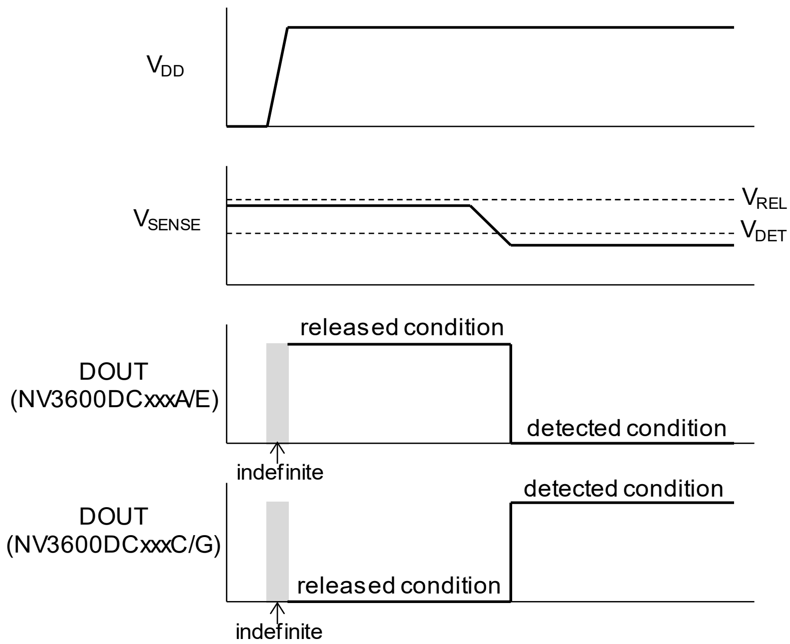
Marking List

Product Code	Detection Voltage (V_{DET}) [V]	Release Voltage (V_{REL}) [V]	① ② ③
NV3600DC001A	3.3	4.5	1 A 0
NV3600DC002A	19.8	22.2	1 A 1
NV3600DC003A	10.0	11.0	1 A 2
NV3600DC004A	5.1	7.6	1 A 3
NV3600DC001C	3.3	4.5	1 B 0
NV3600DC002C	19.8	22.2	1 B 1
NV3600DC003C	10.0	11.0	1 B 2
NV3600DC004C	5.1	7.6	1 B 3
NV3600DC001E	3.3	4.5	1 C 0
NV3600DC002E	19.8	22.2	1 C 1
NV3600DC003E	10.0	11.0	1 C 2
NV3600DC004E	5.1	7.6	1 C 3
NV3600DC001G	3.3	4.5	1 D 0
NV3600DC002G	19.8	22.2	1 D 1
NV3600DC003G	10.0	11.0	1 D 2
NV3600DC004G	5.1	7.6	1 D 3

APPLICATIONS NOTES

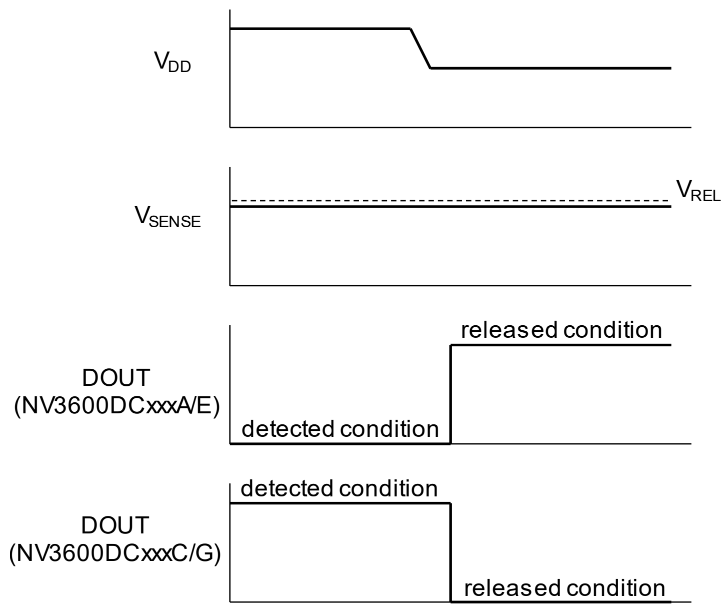
Power-up Considerations

When SENSE pin voltage (V_{SENSE}) is just a little lower than the release voltage, if VDD pin voltage (V_{DD}) power up drastically, released condition may appear. In that case, once SENSE pin should be set lower than the detection voltage to realize "detected condition".
If start-up from the "detected condition" is necessary, put a capacitor (C_{IN}) between VDD pin and GND pin to make rising speed of V_{DD} slow.
In the case of $V_{SENSE} = V_{REL} \times 0.99$, we recommend the rising time of V_{DD} is 100 µs or more. (V_{DD}: from 0 V to 6 V).



Power-down Considerations

When SENSE pin voltage (V_{SENSE}) is just a little lower than the release voltage, if VDD pin voltage (V_{DD}) power down drastically, released condition may appear. In that case, put a capacitor (C_{IN}) between VDD pin and GND pin to make falling speed of V_{DD} slow.
In the case of $V_{SENSE} = V_{REL} \times 0.99$, we recommend the falling slew rate of V_{DD} is slower than -10 mV/µs.

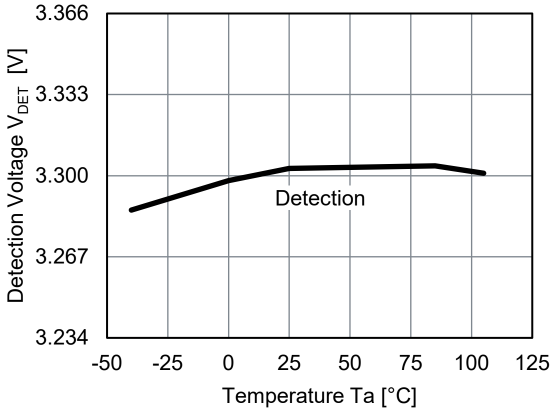


TYPICAL CHARACTERISTICS

Note: Typical Characteristics are intended to be used as reference data; they are not guaranteed.
V_{DD} = 3.3 V, NV3600DCxxxE, Ta = 25 °C unless otherwise noted.

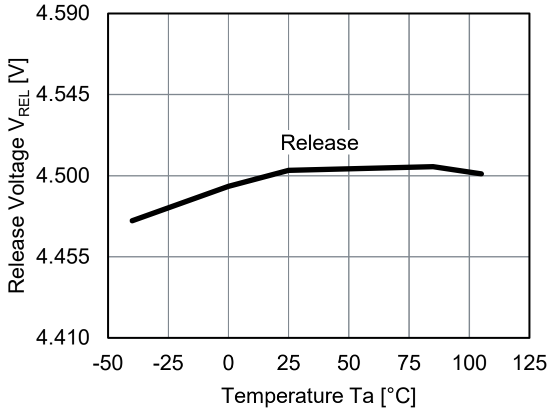
1) Detection Voltage vs Temperature

V_{DET} = 3.3 V

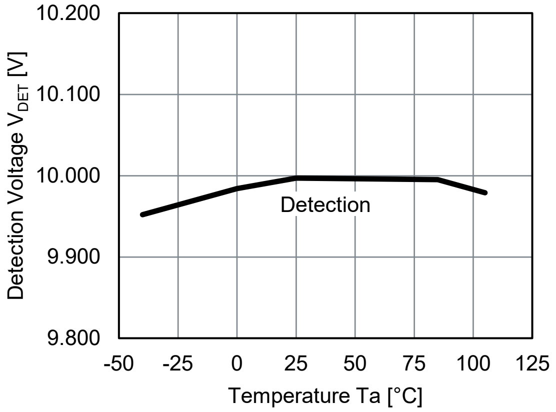


Release Voltage vs Temperature

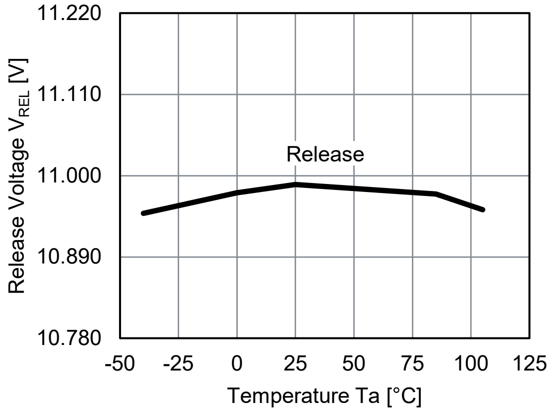
V_{REL} = 4.5 V



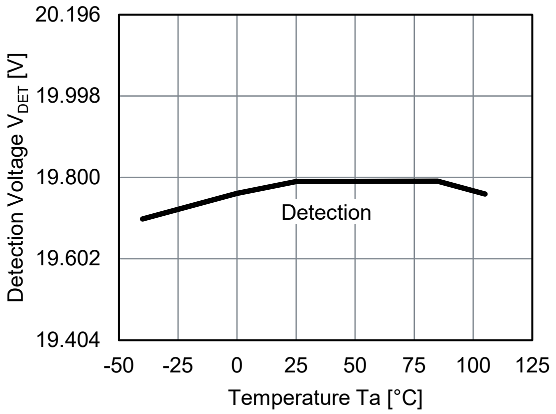
V_{DET} = 10.0 V



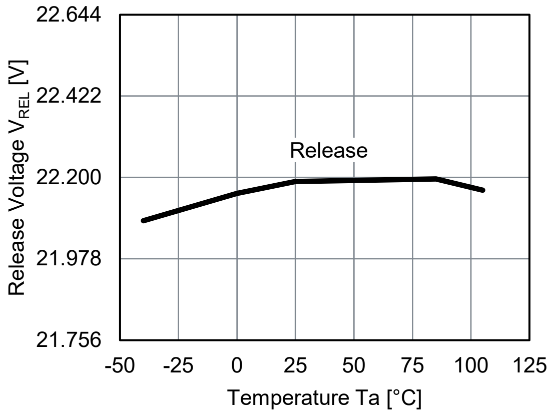
V_{REL} = 11.0 V



V_{DET} = 19.8 V



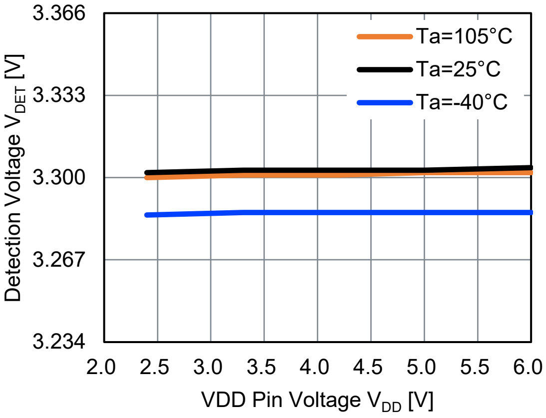
V_{REL} = 22.2 V



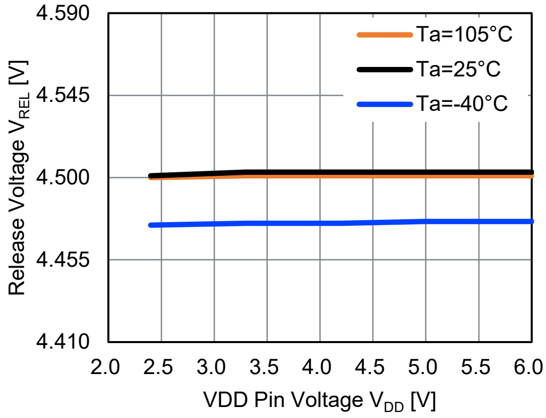
2) Detection Voltage vs VDD Pin Voltage

Release Voltage vs VDD Pin Voltage

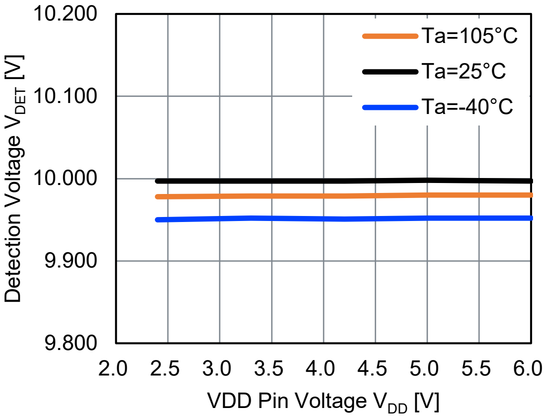
V_{DET} = 3.3 V



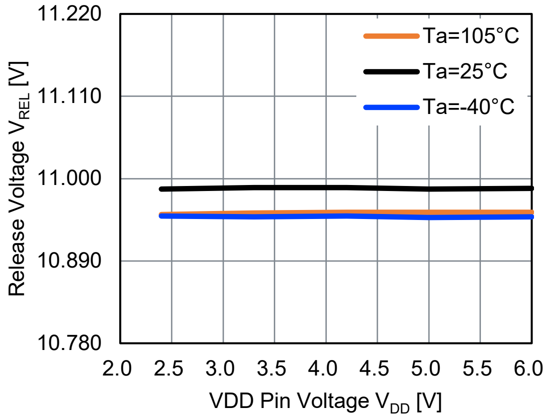
V_{REL} = 4.5 V



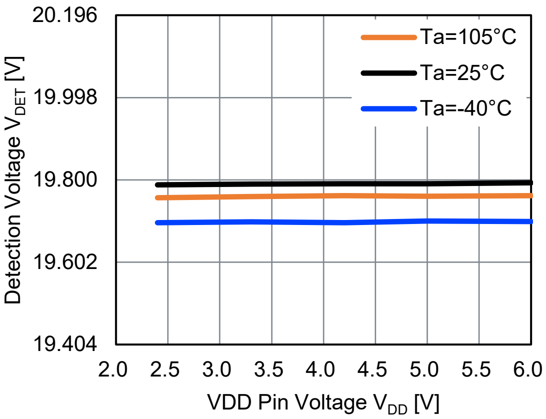
V_{DET} = 10.0 V



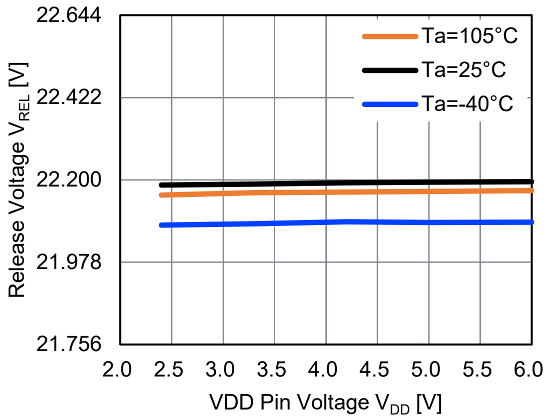
V_{REL} = 11.0 V



V_{DET} = 19.8 V

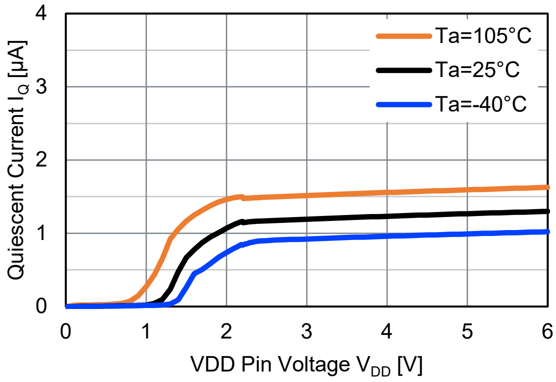


V_{REL} = 22.2 V



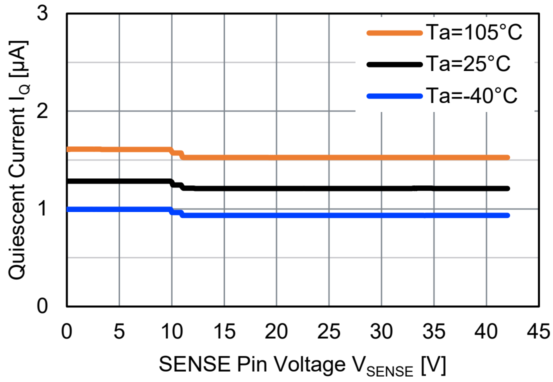
3) Quiescent Current vs VDD Pin Voltage

V_{DET} = 10.0 V, V_{REL} = 11.0 V, V_{SENSE} = V_{REL} + 1V



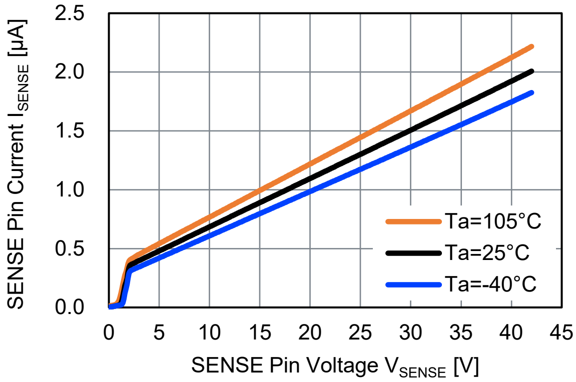
4) Quiescent Current vs SENSE Pin Voltage

V_{DET} = 10.0 V, V_{REL} = 11.0 V

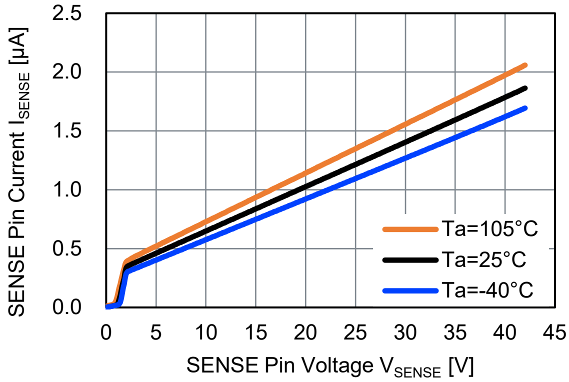


5) SENSE Pin Current vs SENSE Pin Voltage

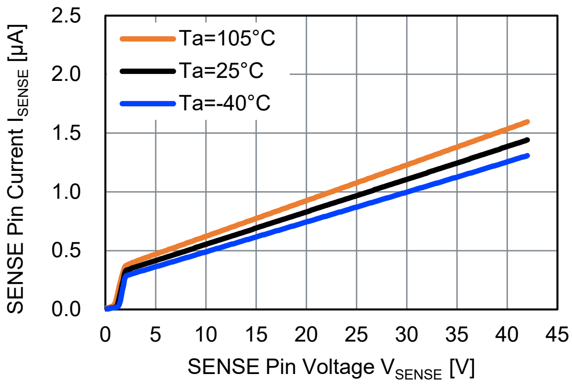
V_{DET} = 3.3 V, V_{REL} = 4.5 V



V_{DET} = 10.0 V, V_{REL} = 11.0 V



V_{DET} = 19.8 V, V_{REL} = 22.2 V

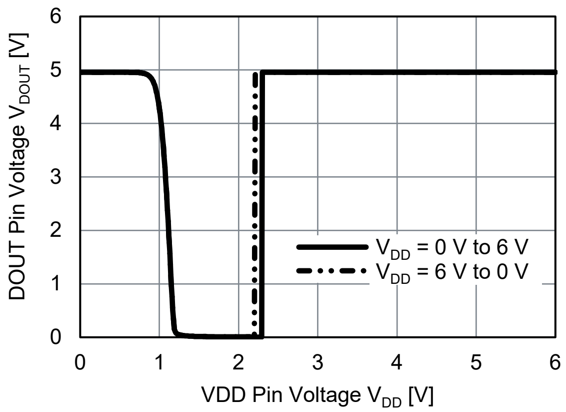


6) DOUT Pin Voltage vs VDD Pin Voltage

NV3600DCxxxA

V_{UP} = 5.0 V, R_{UP} = 100 kΩ

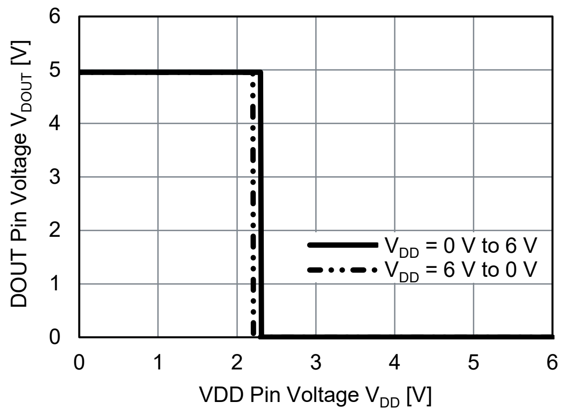
V_{DET} = 10.0 V, V_{REL} = 11.0 V, V_{SENSE} = V_{REL} + 1 V



NV3600DCxxxC

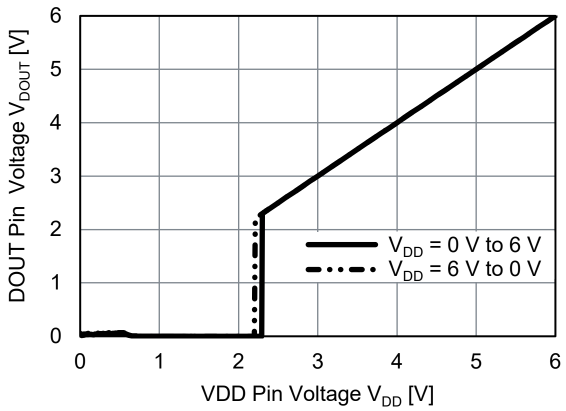
V_{UP} = 5.0 V, R_{UP} = 100 kΩ

V_{DET} = 10.0 V, V_{REL} = 11.0 V, V_{SENSE} = V_{REL} + 1 V



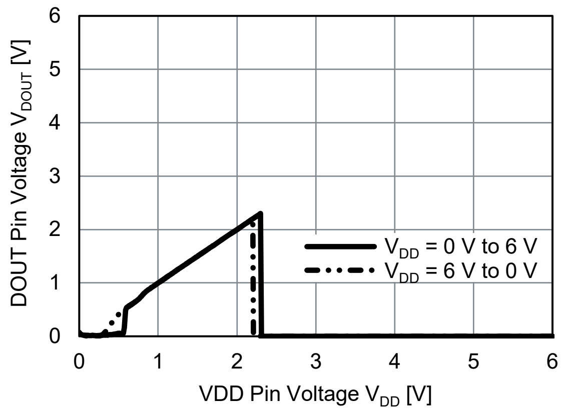
NV3600DCxxxE

V_{DET} = 10.0 V, V_{REL} = 11.0 V, V_{SENSE} = V_{REL} + 1 V



NV3600DCxxxG

V_{DET} = 10.0 V, V_{REL} = 11.0 V, V_{SENSE} = V_{REL} + 1 V

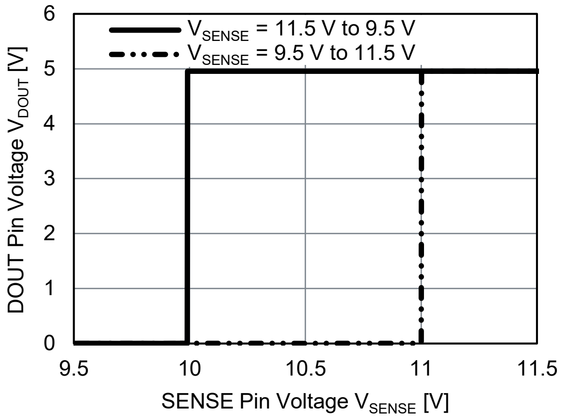


7) DOUT Pin Voltage vs SENSE Pin Voltage

NV3600DCxxxA

V_{UP} = 5.0 V, R_{UP} = 100 kΩ

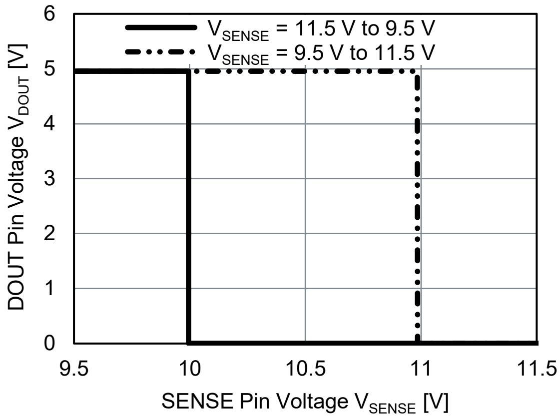
V_{DET} = 10.0 V, V_{REL} = 11.0 V



NV3600DCxxxC

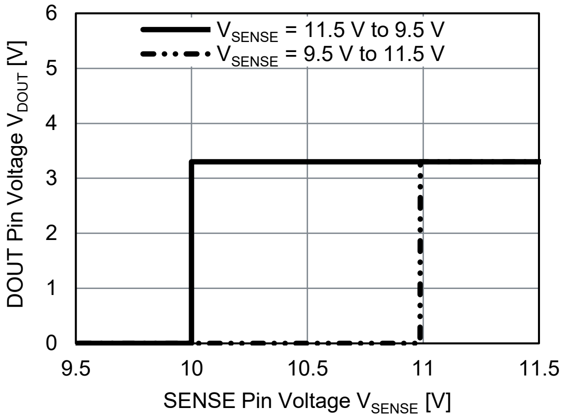
V_{UP} = 5.0 V, R_{UP} = 100 kΩ

V_{DET} = 10.0 V, V_{REL} = 11.0 V



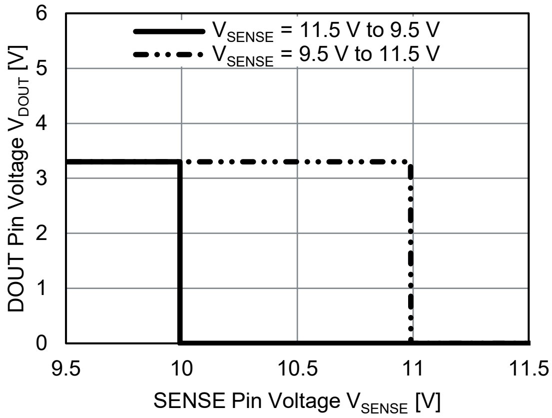
NV3600DCxxxE

V_{DET} = 10.0 V, V_{REL} = 11.0 V



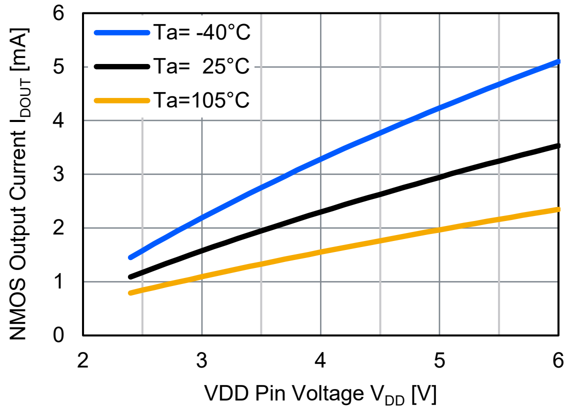
NV3600DCxxxG

V_{DET} = 10.0 V, V_{REL} = 11.0 V



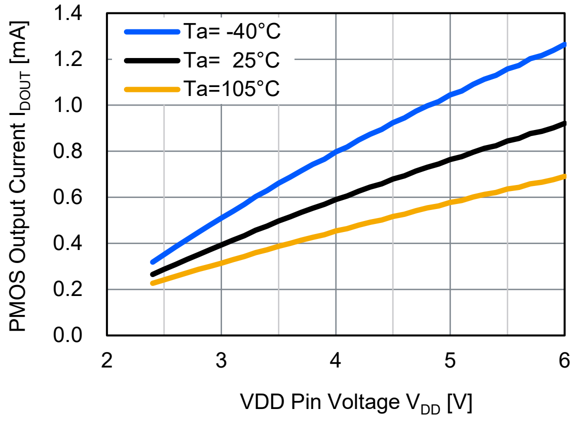
8) NMOS Output Current vs VDD Pin Voltage

V_{DET} = 10.0 V, V_{REL} = 11.0 V, V_{SENSE} = 0 V, V_{DOUT} = 0.1 V



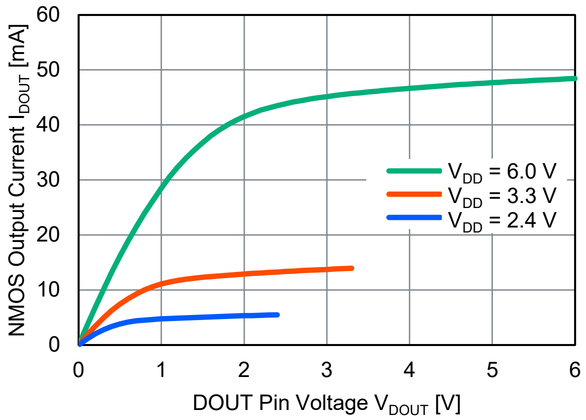
9) PMOS Output Current vs VDD Pin Voltage

V_{DET} = 10.0 V, V_{REL} = 11.0 V, V_{SENSE} = 24 V, V_{DOUT} = V_{DD} - 0.1 V



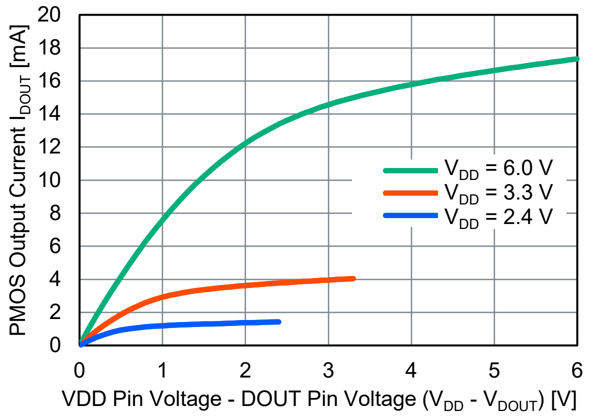
10) NMOS Output Current vs DOUT Pin Voltage

V_{DET} = 10.0 V, V_{REL} = 11.0 V, V_{SENSE} = 0 V, V_{DOUT} = 0 V to V_{DD}



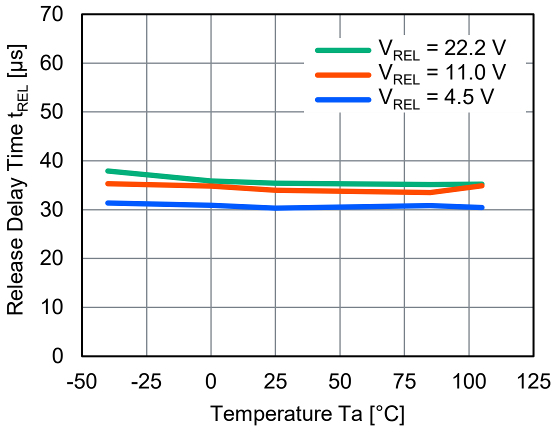
11) PMOS Output Current vs VDD Pin Voltage - DOUT Pin Voltage

V_{DET} = 10.0 V, V_{REL} = 11.0 V, V_{SENSE} = 24 V, V_{DOUT} = V_{DD} to 0 V



12) Release Delay Time vs Temperature

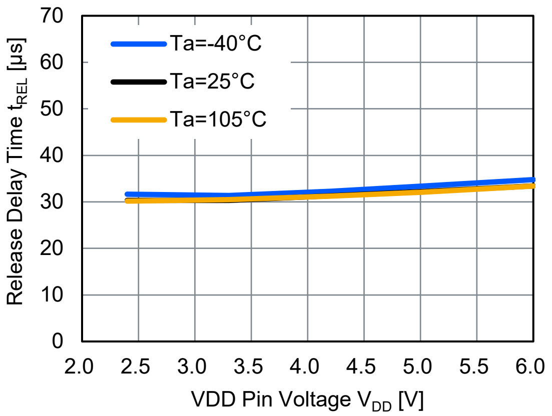
$V_{SENSE} = V_{REL} \times 0.95$ to $V_{REL} \times 1.05$



13) Release Delay Time vs VDD Pin Voltage

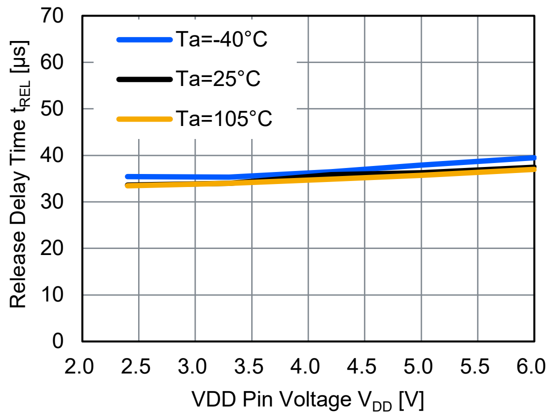
$V_{SENSE} = V_{REL} \times 0.95$ to $V_{REL} \times 1.05$

$V_{DET} = 3.3$ V, $V_{REL} = 4.5$ V



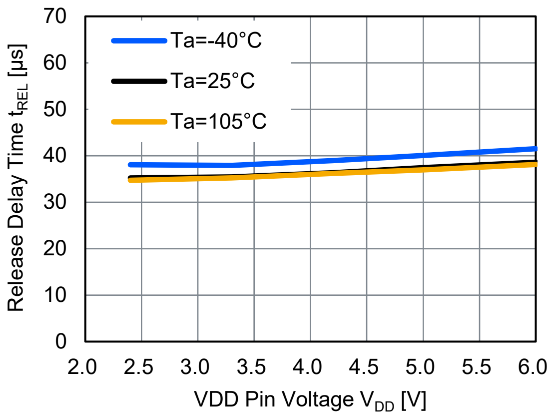
$V_{SENSE} = V_{REL} \times 0.95$ to $V_{REL} \times 1.05$

$V_{DET} = 10.0$ V, $V_{REL} = 11.0$ V



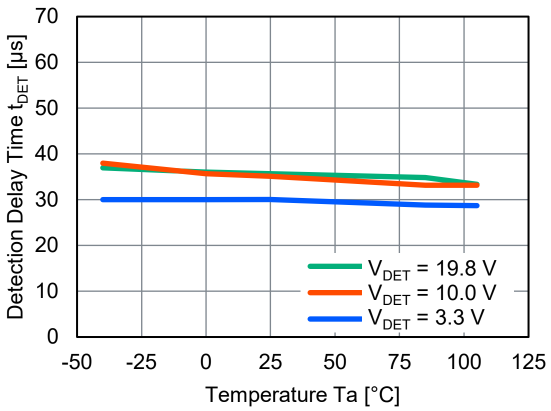
$V_{SENSE} = V_{REL} \times 0.95$ to $V_{REL} \times 1.05$

$V_{DET} = 19.8$ V, $V_{REL} = 22.2$ V



14) Detection Delay Time vs Temperature

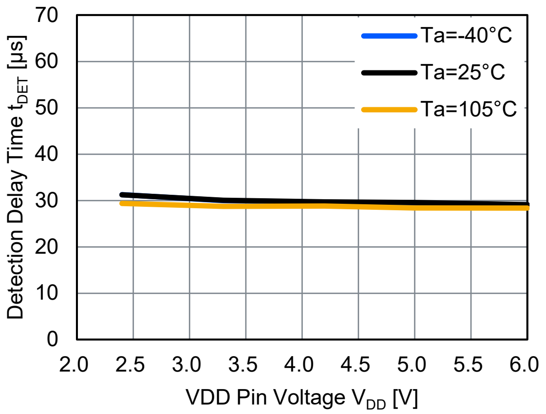
$V_{SENSE} = V_{DET} \times 1.05$ V to $V_{DET} \times 0.95$ V



15) Detection Delay Time vs VDD Pin Voltage

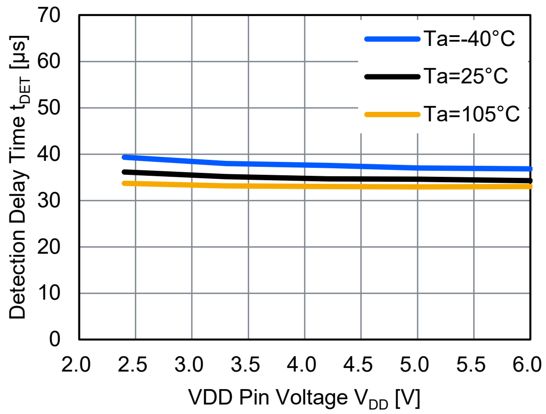
$V_{SENSE} = V_{DET} \times 1.05$ V to $V_{DET} \times 0.95$ V

$V_{DET} = 3.3$ V, $V_{REL} = 4.5$ V



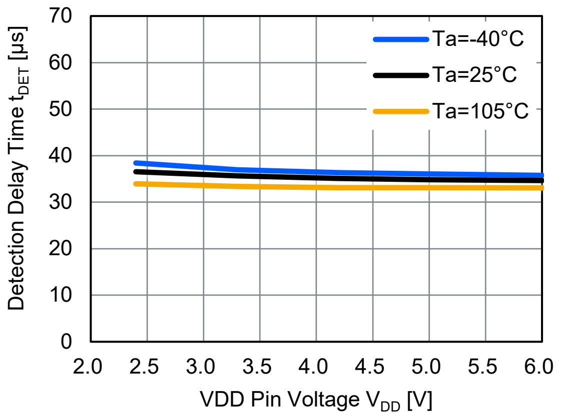
$V_{SENSE} = V_{DET} \times 1.05$ V to $V_{DET} \times 0.95$ V

$V_{DET} = 10.0$ V, $V_{REL} = 11.0$ V



$V_{SENSE} = V_{DET} \times 1.05$ V to $V_{DET} \times 0.95$ V

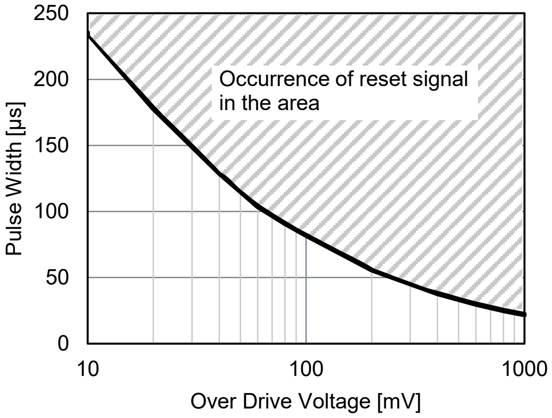
$V_{DET} = 19.8$ V, $V_{REL} = 22.2$ V

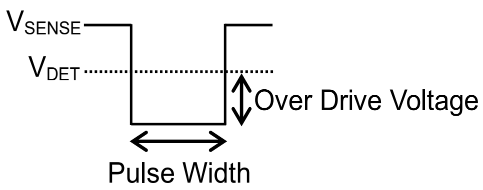


16) SENSE Pin Pulse Width vs Over Drive Voltage

$V_{SENSE} = V_{REL} + 1\ V \Leftrightarrow V_{DET}$ - Over Drive Voltage

$V_{DET} = 10.0\ V$, $V_{REL} = 11.0\ V$



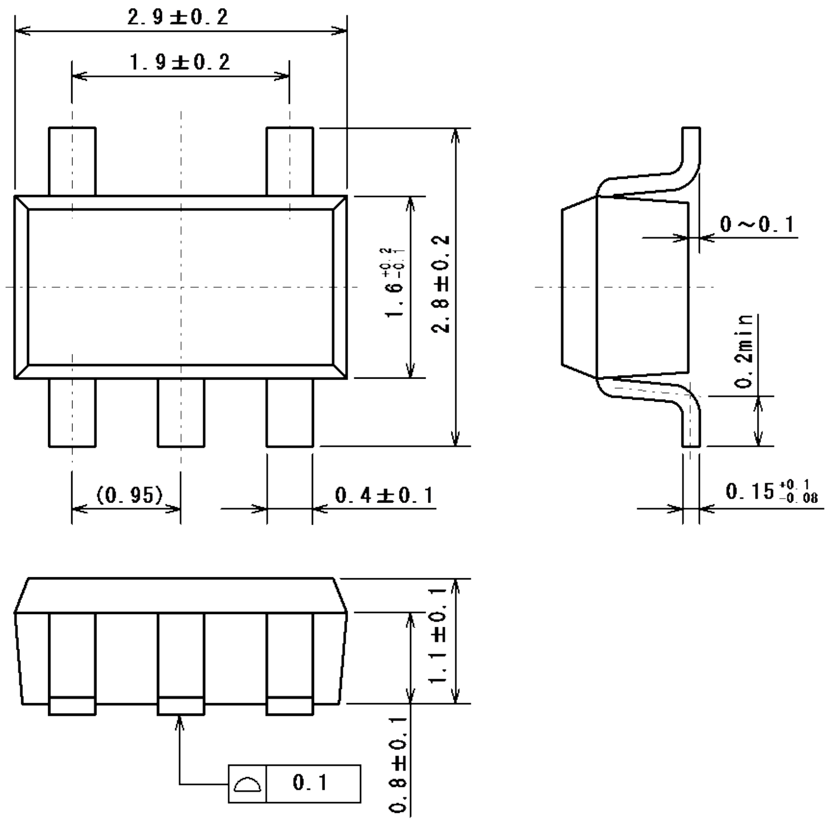


Nisshinbo Micro Devices Inc.

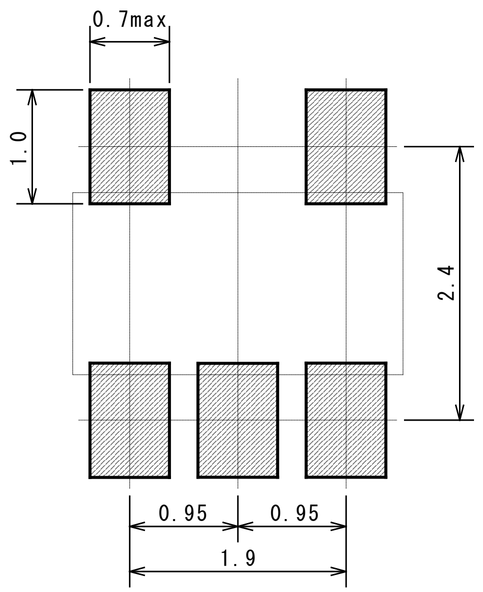
SOT-23-5-DC

■ **PACKAGE DIMENSIONS**

UNIT: mm



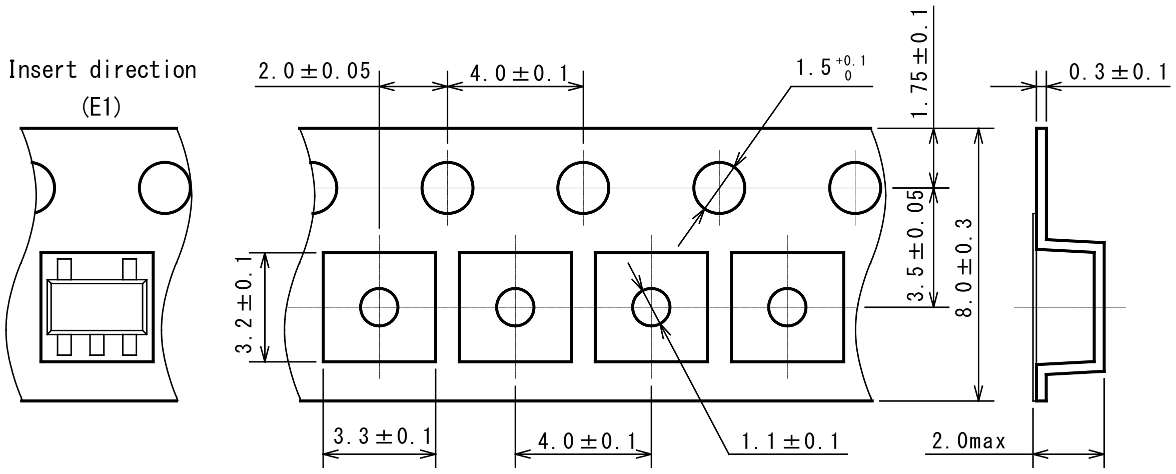
■ **EXAMPLE OF SOLDER PADS DIMENSIONS**



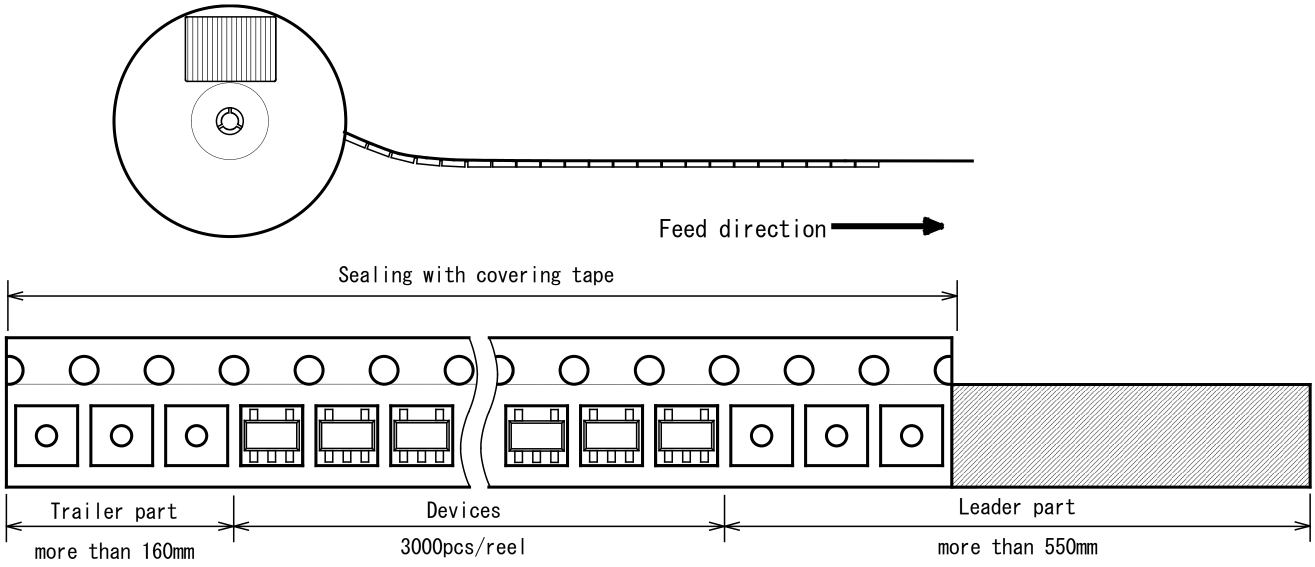
■ **PACKING SPEC**

UNIT: mm

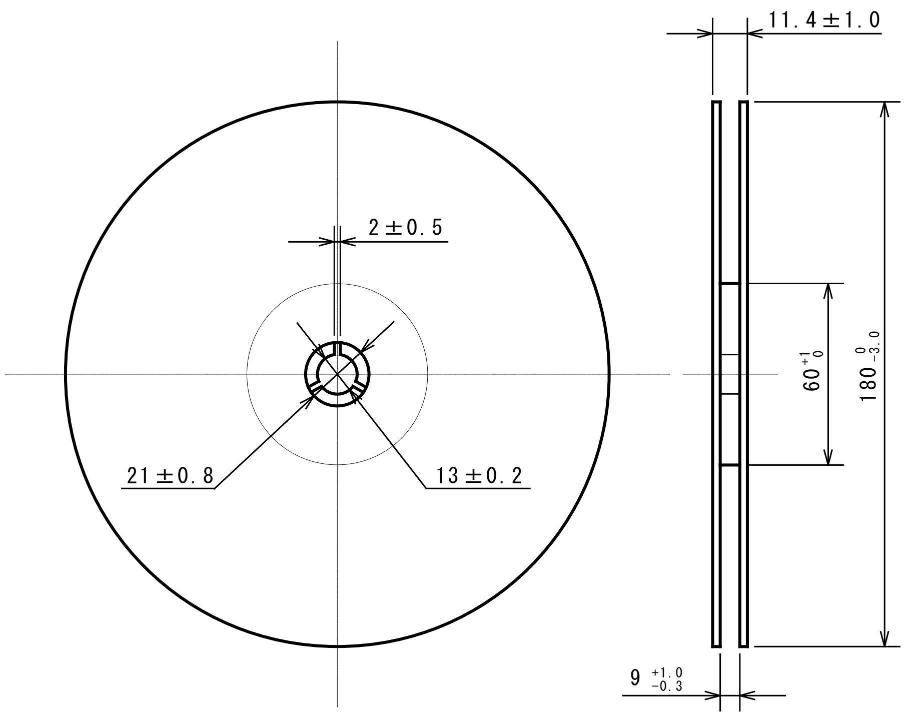
(1) Taping dimensions / Insert direction



(2) Taping state



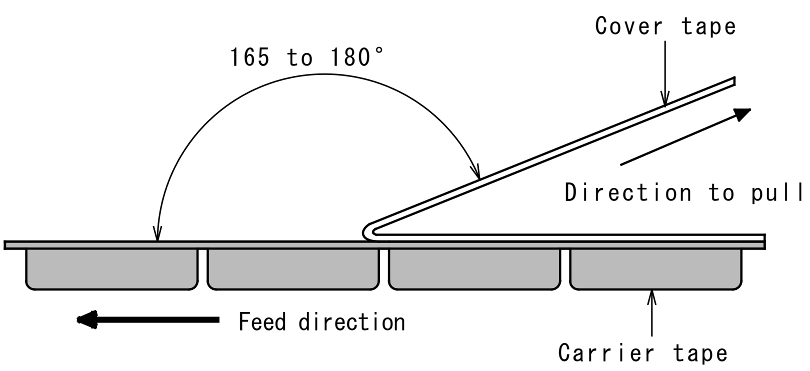
(3) Reel dimensions



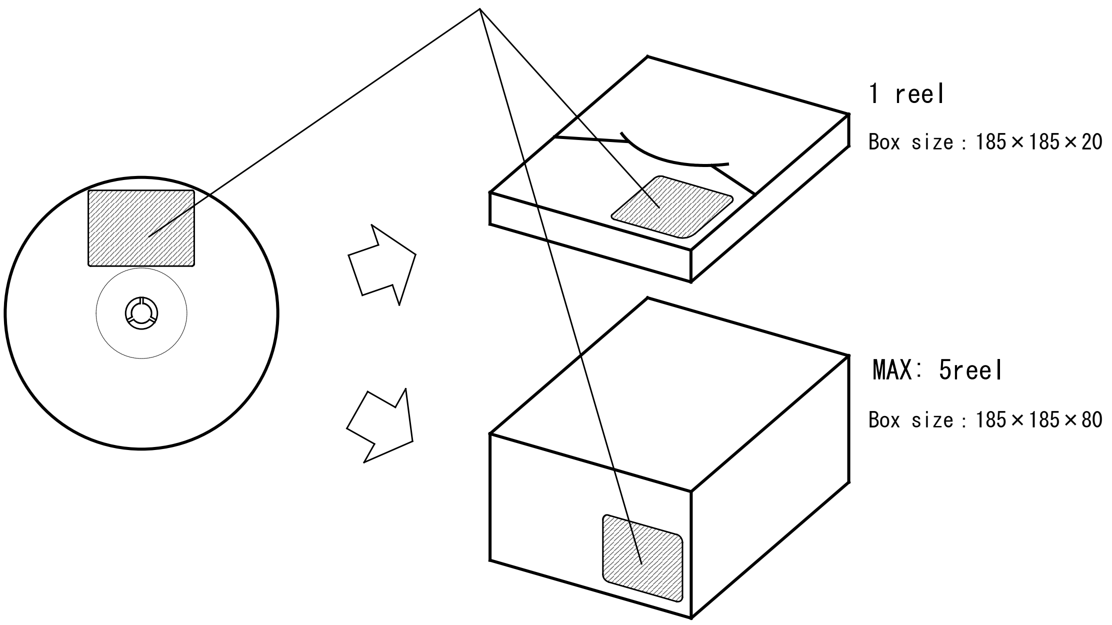
(4) Peeling strength

Peeling strength of cover tape

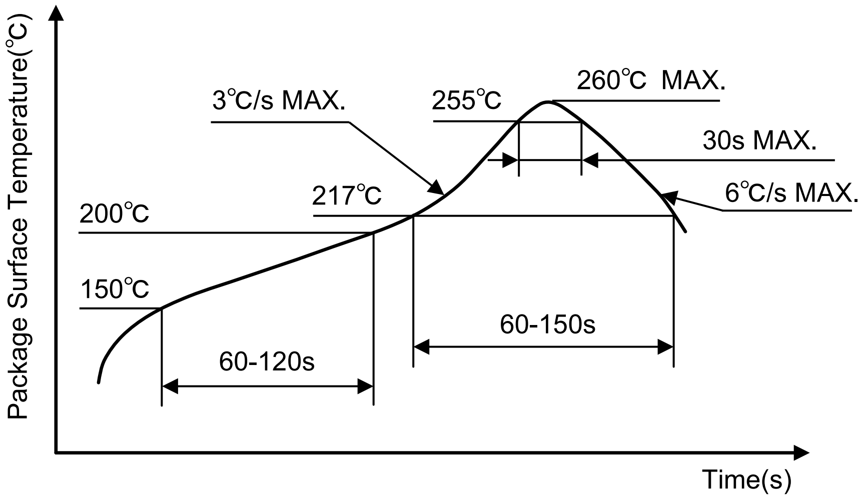
･Peeling angle	165 to 180° degrees to the taped surface.
･Peeling speed	300mm/min
･Peeling strength	0.1 to 1.0N



(5) Packing state



■ **HEAT-RESISTANCE PROFILES**



Reflow profile

REVISION HISTORY

Date	Revision	Contents of Changes
September 08, 2023	1.0	Initial release
February 05, 2024	1.1	Updated “SOT-23-5-DC Package Information” to the latest version. (PI-SOT-23-5-DC-E-E → PI-SOT-23-5-DC-E-F)

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2. The materials in this document may not be copied or otherwise reproduced in whole or in part without the prior written consent of us.
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5. The products listed in this document are intended and designed for use as general electronic components in standard applications (office equipment, telecommunication equipment, measuring instruments, consumer electronic products, amusement equipment etc.). Those customers intending to use a product in an application requiring extreme quality and reliability, for example, in a highly specific application where the failure or misoperation of the product could result in human injury or death should first contact us.
    - Aerospace Equipment
    - Equipment Used in the Deep Sea
    - Power Generator Control Equipment (nuclear, steam, hydraulic, etc.)
    - Life Maintenance Medical Equipment
    - Fire Alarms / Intruder Detectors
    - Vehicle Control Equipment (automotive, airplane, railroad, ship, etc.)
    - Various Safety Devices
    - Traffic control system
    - Combustion equipment

   In case your company desires to use this product for any applications other than general electronic equipment mentioned above, make sure to contact our company in advance. Note that the important requirements mentioned in this section are not applicable to cases where operation requirements such as application conditions are confirmed by our company in writing after consultation with your company.
6. We are making our continuous effort to improve the quality and reliability of our products, but semiconductor products are likely to fail with certain probability. In order to prevent any injury to persons or damages to property resulting from such failure, customers should be careful enough to incorporate safety measures in their design, such as redundancy feature, fire containment feature and fail-safe feature. We do not assume any liability or responsibility for any loss or damage arising from misuse or inappropriate use of the products.
7. The products have been designed and tested to function within controlled environmental conditions. Do not use products under conditions that deviate from methods or applications specified in this datasheet. Failure to employ the products in the proper applications can lead to deterioration, destruction or failure of the products. We shall not be responsible for any bodily injury, fires or accident, property damage or any consequential damages resulting from misuse or misapplication of the products.
8. Quality Warranty
   8-1. Quality Warranty Period
   In the case of a product purchased through an authorized distributor or directly from us, the warranty period for this product shall be one (1) year after delivery to your company. For defective products that occurred during this period, we will take the quality warranty measures described in section 8-2. However, if there is an agreement on the warranty period in the basic transaction agreement, quality assurance agreement, delivery specifications, etc., it shall be followed.
   8-2. Quality Warranty Remedies
   When it has been proved defective due to manufacturing factors as a result of defect analysis by us, we will either deliver a substitute for the defective product or refund the purchase price of the defective product.
   Note that such delivery or refund is sole and exclusive remedies to your company for the defective product.
   8-3. Remedies after Quality Warranty Period
   With respect to any defect of this product found after the quality warranty period, the defect will be analyzed by us. On the basis of the defect analysis results, the scope and amounts of damage shall be determined by mutual agreement of both parties. Then we will deal with upper limit in Section 8-2. This provision is not intended to limit any legal rights of your company.
9. Anti-radiation design is not implemented in the products described in this document.
10. The X-ray exposure can influence functions and characteristics of the products. Confirm the product functions and characteristics in the evaluation stage.
11. WLCSP products should be used in light shielded environments. The light exposure can influence functions and characteristics of the products under operation or storage.
12. Warning for handling Gallium and Arsenic (GaAs) products (Applying to GaAs MMIC, Photo Reflector). These products use Gallium (Ga) and Arsenic (As) which are specified as poisonous chemicals by law. For the prevention of a hazard, do not burn, destroy, or process chemically to make them as gas or power. When the product is disposed of, please follow the related regulation and do not mix this with general industrial waste or household waste.
13. Please contact our sales representatives should you have any questions or comments concerning the products or the technical information.

NISSHINBO

Nisshinbo Micro Devices Inc.

Official website
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