

# NX3P1108

## Logic controlled high-side power switch

Rev. 2 — 20 June 2018

Product data sheet

### 1. General description

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The NX3P1108 is a high-side load switch which features a low ON resistance P-channel MOSFET that supports more than 1.5 A of continuous current. It has an integrated output discharge resistor to discharge the output capacitance when disabled. Designed for operation from 0.9 V to 3.6 V, it is used in power domain isolation applications to reduce power dissipation and extend battery life. The enable logic includes integrated logic level translation making the device compatible with lower voltage processors and controllers. The NX3P1108 is ideal for portable, battery operated applications due to low ground current and ultra-low OFF-state current.

### 2. Features and benefits

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- Wide supply voltage range from 0.9 V to 3.6 V
- Very low ON resistance:
  - ◆ 34 mΩ at a supply voltage of 3.3 V
- High noise immunity
- Low OFF-state leakage current (2.0 μA maximum)
- 1.2 V control logic at a supply voltage of 3.6 V
- High current handling capability (1.5 A continuous current)
- Internal output discharge resistor
- Turn-on slew rate limiting
- ESD protection:
  - ◆ HBM JESD22-A114F Class 3A exceeds 4000 V
  - ◆ CDM AEC-Q100-011 revision B exceeds 500 V
- Specified from -40 °C to +85 °C

### 3. Applications

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- Cell phone
- Digital cameras and audio devices
- Portable and battery-powered equipment



4. Ordering information

Table 1. Ordering information

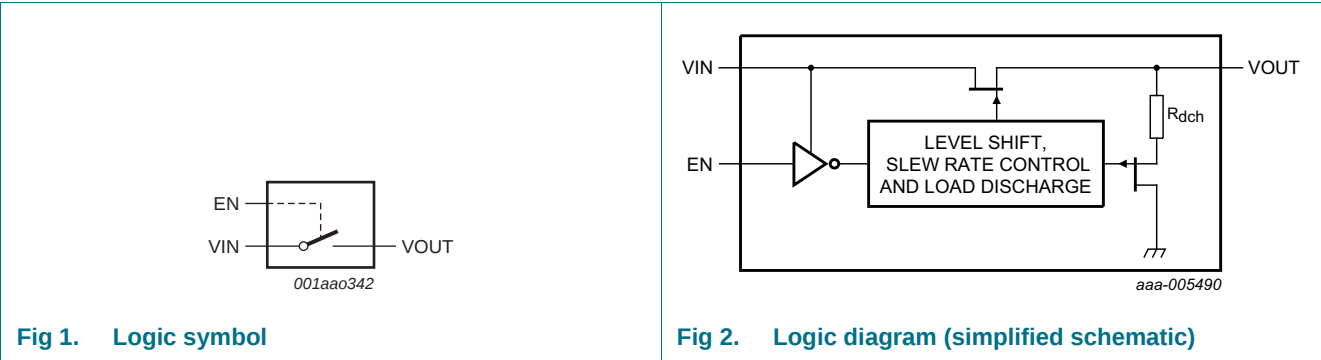
| Type number | Package           |        |                                                                                                       |           |
|-------------|-------------------|--------|-------------------------------------------------------------------------------------------------------|-----------|
|             | Temperature range | Name   | Description                                                                                           | Version   |
| NX3P1108UK  | −40 °C to +85 °C  | WLCSP4 | wafer level chip-scale package; 4 bumps; 0.97 mm x 0.97 mm x 0.54 mm body (backside coating included) | SOT1376-2 |

5. Marking

Table 2. Marking codes

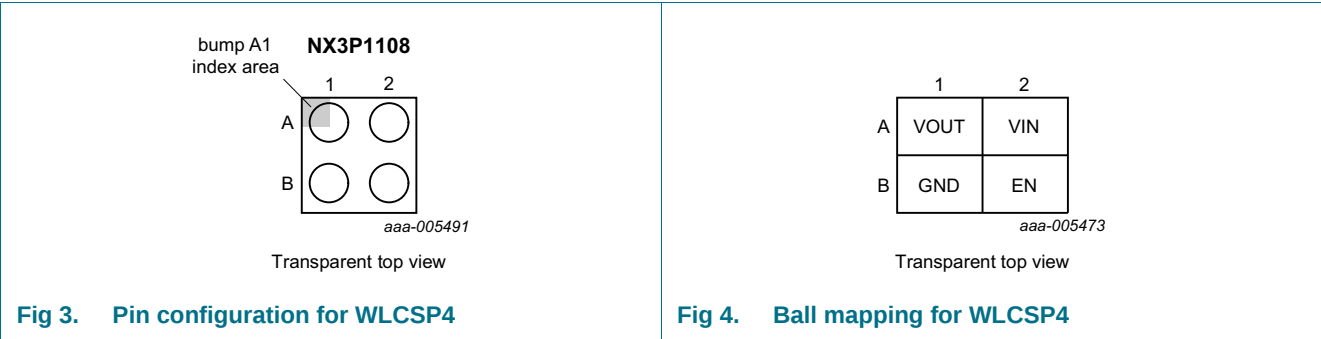
| Type number | Marking code |
|-------------|--------------|
| NX3P1108UK  | xB           |

6. Functional diagram



7. Pinning information

7.1 Pinning



## 7.2 Pin description

Table 3. Pin description

| Symbol | Pin | Description                |
|--------|-----|----------------------------|
| VOUT   | A1  | output voltage             |
| GND    | B1  | ground (0 V)               |
| VIN    | A2  | input voltage              |
| EN     | B2  | enable input (active HIGH) |

## 8. Functional description

Table 4. Function table<sup>[1]</sup>

| Input EN | Switch     |
|----------|------------|
| L        | switch OFF |
| H        | switch ON  |

[1] H = HIGH voltage level; L = LOW voltage level.

## 9. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

| Symbol              | Parameter                    | Conditions                                                      |     | Min  | Max                 | Unit |
|---------------------|------------------------------|-----------------------------------------------------------------|-----|------|---------------------|------|
| V <sub>I</sub>      | input voltage                | input EN                                                        | [1] | −0.5 | +4.0                | V    |
|                     |                              | input VIN                                                       | [2] | −0.5 | +4.0                | V    |
| V <sub>SW</sub>     | switch voltage               | output VOUT                                                     | [2] | −0.5 | V <sub>I(VIN)</sub> | V    |
| I <sub>IK</sub>     | input clamping current       | input EN: V <sub>I(EN)</sub> < −0.5 V                           |     | −50  | -                   | mA   |
| I <sub>SK</sub>     | switch clamping current      | input VIN: V <sub>I(VIN)</sub> < −0.5 V                         |     | −50  | -                   | mA   |
|                     |                              | output VOUT: V <sub>O(VOUT)</sub> < −0.5 V                      |     | −50  | -                   | mA   |
|                     |                              | output VOUT: V <sub>O(VOUT)</sub> > V <sub>I(VIN)</sub> + 0.5 V |     | -    | 50                  | mA   |
| I <sub>SW</sub>     | switch current               | V <sub>SW</sub> > −0.5 V                                        |     | -    | ±1500               | mA   |
| T <sub>j(max)</sub> | maximum junction temperature |                                                                 |     | −40  | +125                | °C   |
| T <sub>stg</sub>    | storage temperature          |                                                                 |     | −65  | +150                | °C   |
| P <sub>tot</sub>    | total power dissipation      |                                                                 | [3] | -    | 300                 | mW   |

[1] The minimum input voltage rating may be exceeded if the input current rating is observed.

[2] The minimum and maximum switch voltage ratings may be exceeded if the switch clamping current rating is observed.

[3] The (absolute) maximum power dissipation depends on the junction temperature T<sub>j</sub>. Higher power dissipation is allowed in conjunction with lower ambient temperatures. The conditions to determine the specified values are T<sub>amb</sub> = 85 °C and the use of a two layer PCB.

## 10. Recommended operating conditions

Table 6. Recommended operating conditions

| Symbol    | Parameter           | Conditions | Min | Max | Unit |
|-----------|---------------------|------------|-----|-----|------|
| $V_I$     | input voltage       |            | 0.9 | 3.6 | V    |
| $T_{amb}$ | ambient temperature |            | -40 | +85 | °C   |

## 11. Thermal characteristics

Table 7. Thermal characteristics

| Symbol        | Parameter                                   | Conditions | Typ                                        | Unit |
|---------------|---------------------------------------------|------------|--------------------------------------------|------|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient |            | <a href="#">[1]</a> <a href="#">[2]</a> 84 | K/W  |

- [1] The overall  $R_{th(j-a)}$  can vary depending on the board layout. To minimize the effective  $R_{th(j-a)}$ , all pins must have a solid connection to larger Cu layer areas for example, to the power and ground layer. In multi-layer PCB applications, use the second layer to create a large heat spreader area right below the device. If this layer is either ground or power, connect it with several vias to the top layer connected to the device ground or supply. Try not to use any solder-stop varnish under the chip.
- [2] Rely on the measurement data given for a rough estimation of the  $R_{th(j-a)}$  in your application. The actual  $R_{th(j-a)}$  value may vary in applications using different layer stacks and layouts

## 12. Static characteristics

Table 8. Static characteristics

$V_{I(VIN)} = 0.9\text{ V to }3.6\text{ V}$ , unless otherwise specified; Voltages are referenced to GND (ground = 0 V).

| Symbol   | Parameter                | Conditions                                                                                                                                        | $T_{amb} = 25\text{ °C}$ |     |     | $T_{amb} = -40\text{ °C to }+85\text{ °C}$ |     | Unit |
|----------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-----|-----|--------------------------------------------|-----|------|
|          |                          |                                                                                                                                                   | Min                      | Typ | Max | Min                                        | Max |      |
| $V_{IH}$ | HIGH-level input voltage | EN input                                                                                                                                          |                          |     |     |                                            |     |      |
|          |                          | $V_{I(VIN)} = 0.9\text{ V to }1.1\text{ V}$                                                                                                       | -                        | -   | -   | 0.8                                        | -   | V    |
|          |                          | $V_{I(VIN)} = 1.1\text{ V to }1.3\text{ V}$                                                                                                       | -                        | -   | -   | 1.0                                        | -   | V    |
|          |                          | $V_{I(VIN)} = 1.3\text{ V to }1.8\text{ V}$                                                                                                       | -                        | -   | -   | 1.1                                        | -   | V    |
| $V_{IL}$ | LOW-level input voltage  | EN input                                                                                                                                          |                          |     |     |                                            |     |      |
|          |                          | $V_{I(VIN)} = 0.9\text{ V to }1.1\text{ V}$                                                                                                       | -                        | -   | -   | -                                          | 0.2 | V    |
|          |                          | $V_{I(VIN)} = 1.1\text{ V to }1.3\text{ V}$                                                                                                       | -                        | -   | -   | -                                          | 0.3 | V    |
|          |                          | $V_{I(VIN)} = 1.3\text{ V to }1.8\text{ V}$                                                                                                       | -                        | -   | -   | -                                          | 0.4 | V    |
| $I_I$    | input leakage current    | $V_{I(EN)} = 0\text{ V or }3.6\text{ V}$                                                                                                          | -                        | 0.1 | -   | -                                          | 1   | μA   |
|          |                          | $V_{I(EN)} = 0\text{ V or }3.6\text{ V}$ ; VOUT open; see <a href="#">Figure 5</a> and <a href="#">Figure 6</a>                                   | -                        | -   | -   | -2                                         | -   | μA   |
|          |                          | $V_{I(VIN)} = 3.6\text{ V}$ ; $V_{I(EN)} = \text{GND}$ ; $V_{I(VOUT)} = \text{GND}$ ; see <a href="#">Figure 10</a> and <a href="#">Figure 11</a> | -                        | 0.1 | -   | -                                          | 2.0 | μA   |
|          |                          | VOUT output; $V_{I(VIN)} = 3.3\text{ V}$                                                                                                          | -                        | 120 | -   | -                                          | -   | Ω    |

12.1 Graphs

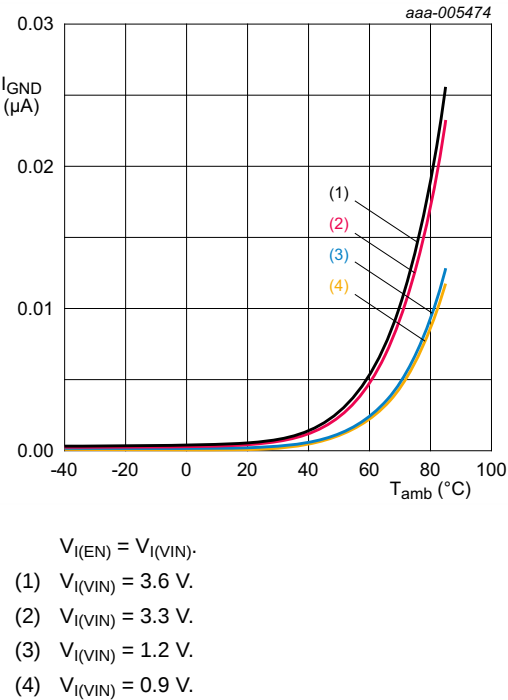


Fig 5. Waveform showing the ground current versus temperature

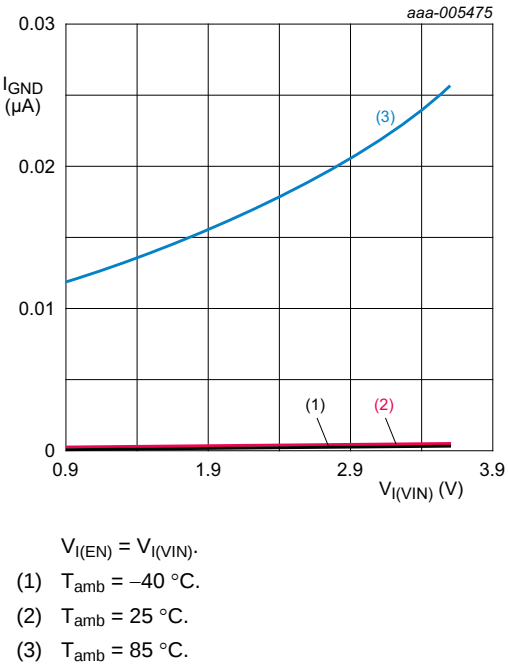


Fig 6. Waveform showing the ground current versus input voltage on pin VIN

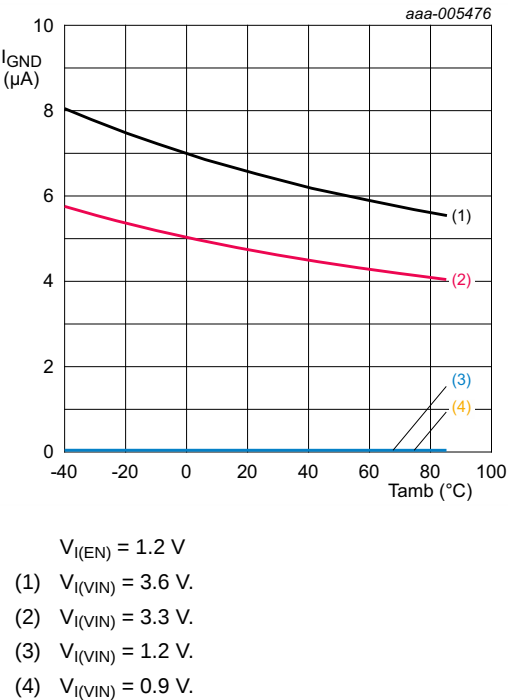


Fig 7. Waveform showing the ground current versus temperature

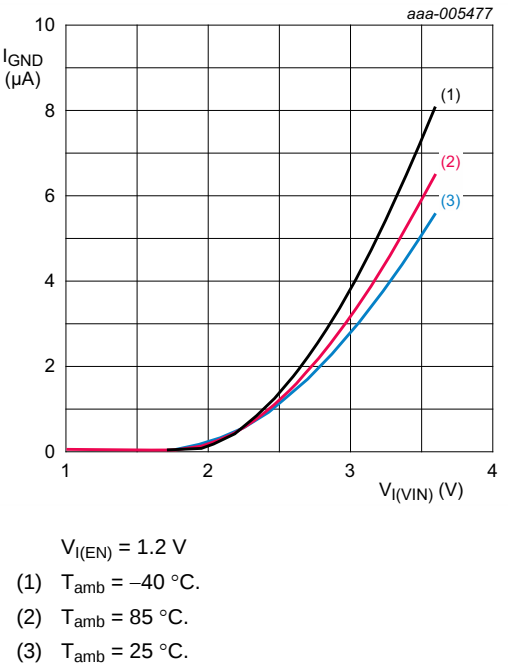
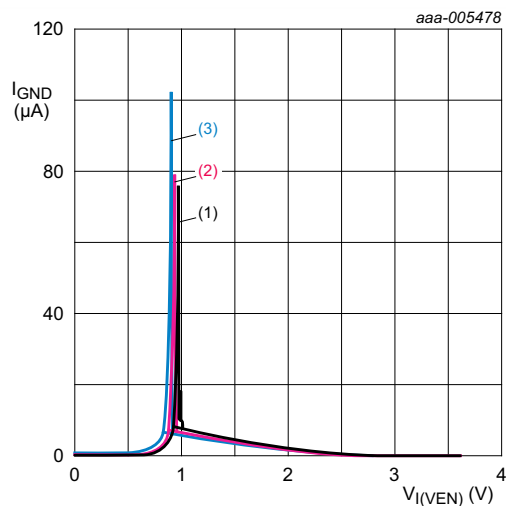
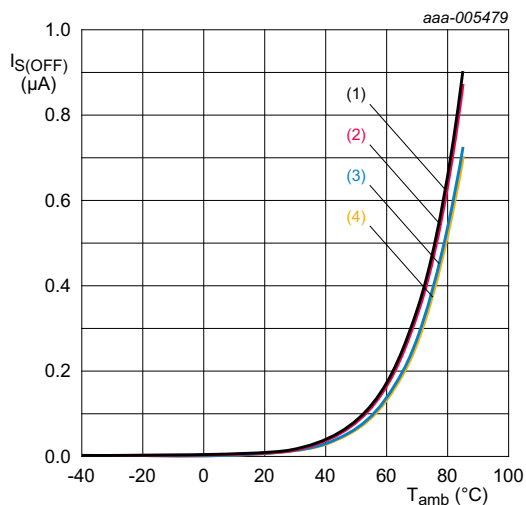


Fig 8. Waveform showing the ground current versus input voltage on pin VIN



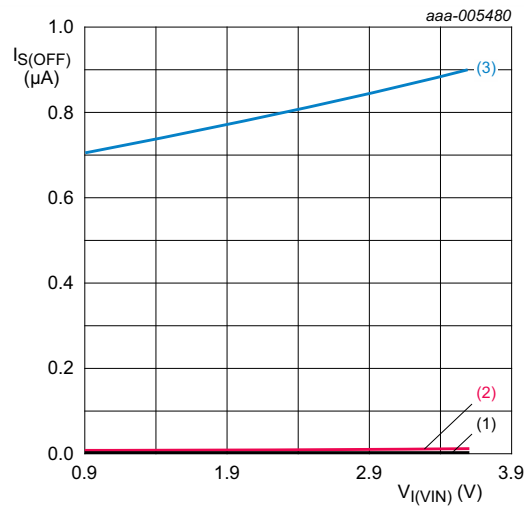
- (1)  $T_{amb} = -40\text{ }^{\circ}\text{C}$ .
- (2)  $T_{amb} = 85\text{ }^{\circ}\text{C}$ .
- (3)  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

**Fig 9. Waveform showing the ground current versus input voltage on pin EN**



- $V_{I(EN)} = \text{GND}$ .
- (1)  $V_{I(VIN)} = 3.6\text{ V}$ .
  - (2)  $V_{I(VIN)} = 3.3\text{ V}$ .
  - (3)  $V_{I(VIN)} = 1.2\text{ V}$ .
  - (4)  $V_{I(VIN)} = 0.9\text{ V}$ .

**Fig 10. Waveforms showing the OFF-state leakage current versus temperature**



- (1)  $T_{amb} = -40^{\circ}C$ .
- (2)  $T_{amb} = 25^{\circ}C$ .
- (3)  $T_{amb} = 85^{\circ}C$ .

Fig 11. Waveforms showing the OFF-state leakage current versus input voltage on pin VIN

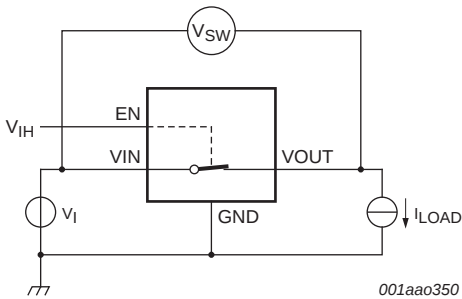
12.2 ON resistance

Table 9. ON resistance  
At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

| Symbol          | Parameter     | Conditions                                                                                                                                                     | T <sub>amb</sub> = -40 °C to +85 °C |                    |     | Unit |
|-----------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|--------------------|-----|------|
|                 |               |                                                                                                                                                                | Min                                 | Typ <sup>[1]</sup> | Max |      |
| R <sub>ON</sub> | ON resistance | V <sub>I(EN)</sub> = V <sub>I(VIN)</sub> ; I <sub>LOAD</sub> = 200 mA; see <a href="#">Figure 12</a> , <a href="#">Figure 13</a> and <a href="#">Figure 14</a> |                                     |                    |     |      |
|                 |               | V <sub>I(VIN)</sub> = 0.9 V                                                                                                                                    | -                                   | 105                | 140 | mΩ   |
|                 |               | V <sub>I(VIN)</sub> = 1.2 V                                                                                                                                    | -                                   | 68                 | 81  | mΩ   |
|                 |               | V <sub>I(VIN)</sub> = 1.5 V                                                                                                                                    | -                                   | 55                 | 65  | mΩ   |
|                 |               | V <sub>I(VIN)</sub> = 1.8 V                                                                                                                                    | -                                   | 50                 | 55  | mΩ   |
|                 |               | V <sub>I(VIN)</sub> = 2.5 V                                                                                                                                    | -                                   | 40                 | 44  | mΩ   |
|                 |               | V <sub>I(VIN)</sub> = 3.3 V                                                                                                                                    | -                                   | 34                 | 40  | mΩ   |

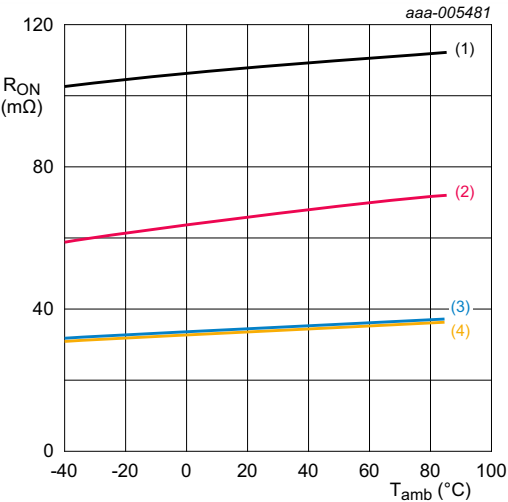
[1] Typical values are measured at T<sub>amb</sub> = 25 °C.

12.3 ON resistance test circuit and waveforms



$R_{ON} = V_{SW} / I_{LOAD}$

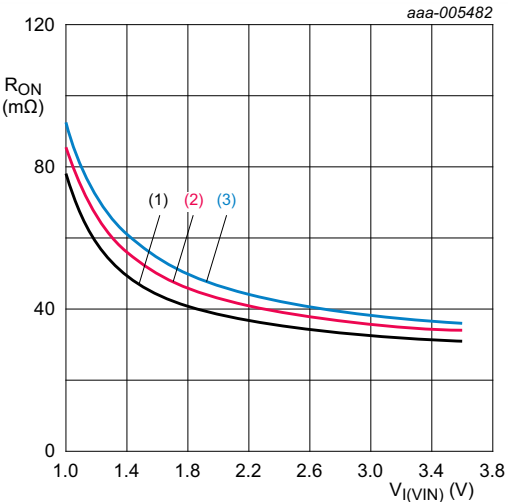
Fig 12. Test circuit for measuring ON resistance



$I_{LOAD} = 200\text{ mA}$ .

- (1)  $V_{I(VIN)} = 0.9\text{ V}$ .
- (2)  $V_{I(VIN)} = 1.2\text{ V}$ .
- (3)  $V_{I(VIN)} = 3.3\text{ V}$ .
- (4)  $V_{I(VIN)} = 3.6\text{ V}$ .

Fig 13. Waveform showing the ON resistance versus temperature



$V_{I(EN)} = V_{I(VIN)}$ ;  $I_{LOAD} = 200\text{ mA}$

- (1)  $T_{amb} = -40\text{ °C}$ .
- (2)  $T_{amb} = 25\text{ °C}$ .
- (3)  $T_{amb} = 85\text{ °C}$ .

Fig 14. Waveform showing the ON resistance versus input voltage

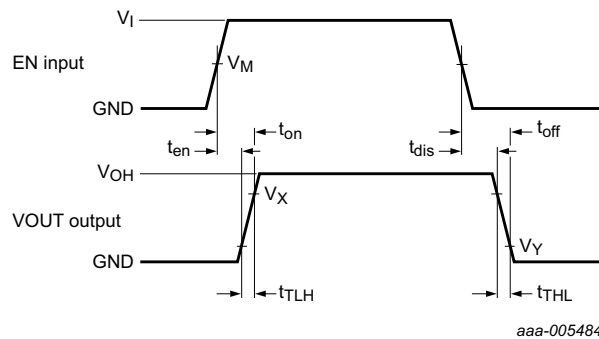
## 13. Dynamic characteristics

**Table 10. Dynamic characteristics**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 16](#).

| Symbol    | Parameter                          | Conditions                                | $T_{amb} = 25\text{ }^{\circ}\text{C}$ |      |     | Unit          |
|-----------|------------------------------------|-------------------------------------------|----------------------------------------|------|-----|---------------|
|           |                                    |                                           | Min                                    | Typ  | Max |               |
| $t_{en}$  | enable time                        | EN to VOUT; see <a href="#">Figure 15</a> |                                        |      |     |               |
|           |                                    | $V_{I(VIN)} = 1.8\text{ V}$               | -                                      | 120  | -   | $\mu\text{S}$ |
|           |                                    | $V_{I(VIN)} = 3.3\text{ V}$               | -                                      | 70   | -   | $\mu\text{S}$ |
| $t_{dis}$ | disable time                       | EN to VOUT; see <a href="#">Figure 15</a> |                                        |      |     |               |
|           |                                    | $V_{I(VIN)} = 1.8\text{ V}$               | -                                      | 1.5  | -   | $\mu\text{S}$ |
|           |                                    | $V_{I(VIN)} = 3.3\text{ V}$               | -                                      | 1.5  | -   | $\mu\text{S}$ |
| $t_{on}$  | turn-on time                       | EN to VOUT; see <a href="#">Figure 15</a> |                                        |      |     |               |
|           |                                    | $V_{I(VIN)} = 1.8\text{ V}$               | -                                      | 220  | -   | $\mu\text{S}$ |
|           |                                    | $V_{I(VIN)} = 3.3\text{ V}$               | -                                      | 150  | -   | $\mu\text{S}$ |
| $t_{off}$ | turn-off time                      | EN to VOUT; see <a href="#">Figure 15</a> |                                        |      |     |               |
|           |                                    | $V_{I(VIN)} = 1.8\text{ V}$               | -                                      | 25   | -   | $\mu\text{S}$ |
|           |                                    | $V_{I(VIN)} = 3.3\text{ V}$               | -                                      | 22.5 | -   | $\mu\text{S}$ |
| $t_{TLH}$ | LOW to HIGH output transition time | VOUT; see <a href="#">Figure 15</a>       |                                        |      |     |               |
|           |                                    | $V_{I(VIN)} = 1.8\text{ V}$               | -                                      | 100  | -   | $\mu\text{S}$ |
|           |                                    | $V_{I(VIN)} = 3.3\text{ V}$               | -                                      | 80   | -   | $\mu\text{S}$ |
| $t_{THL}$ | HIGH to LOW output transition time | VOUT; see <a href="#">Figure 15</a>       |                                        |      |     |               |
|           |                                    | $V_{I(VIN)} = 1.8\text{ V}$               | -                                      | 23.5 | -   | $\mu\text{S}$ |
|           |                                    | $V_{I(VIN)} = 3.3\text{ V}$               | -                                      | 21   | -   | $\mu\text{S}$ |

### 13.1 Waveform and test circuits



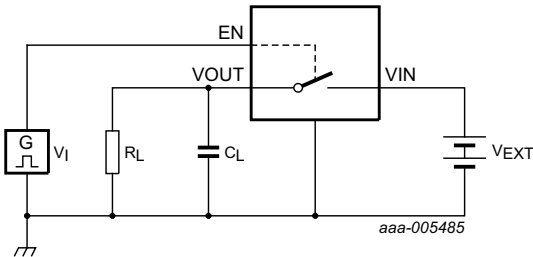
Measurement points are given in [Table 11](#).

Logic level:  $V_{OH}$  is the typical output voltage that occurs with the output load.

**Fig 15. Switching times**

Table 11. Measurement points

| Supply voltage | EN Input         | Output              |                     |
|----------------|------------------|---------------------|---------------------|
| $V_{I(VIN)}$   | $V_M$            | $V_X$               | $V_Y$               |
| 0.9 V to 3.6 V | $0.5 \times V_I$ | $0.9 \times V_{OH}$ | $0.1 \times V_{OH}$ |

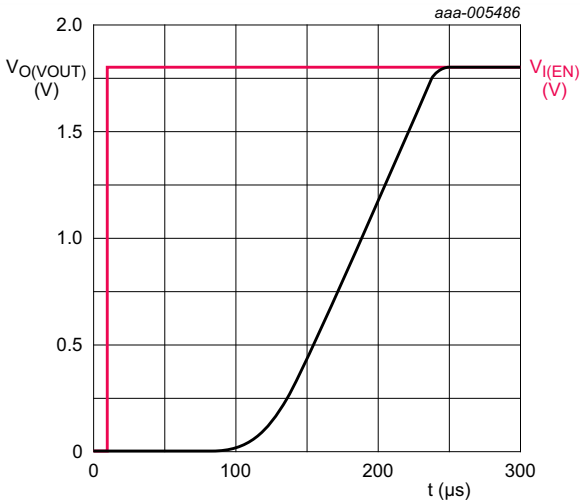


Test data is given in [Table 12](#).  
Definitions test circuit:  
 $R_L$  = Load resistance.  
 $C_L$  = Load capacitance including jig and probe capacitance.  
 $V_{EXT}$  = External voltage for measuring switching times.

Fig 16. Test circuit for measuring switching times

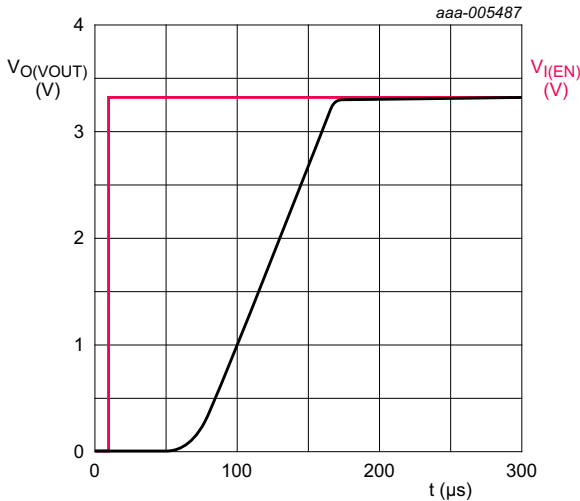
Table 12. Test data

| Supply voltage | EN Input | Load        |              |
|----------------|----------|-------------|--------------|
| $V_{EXT}$      | $V_I$    | $C_L$       | $R_L$        |
| 0.9 V to 3.6 V | 3.3 V    | 0.1 $\mu$ F | 500 $\Omega$ |



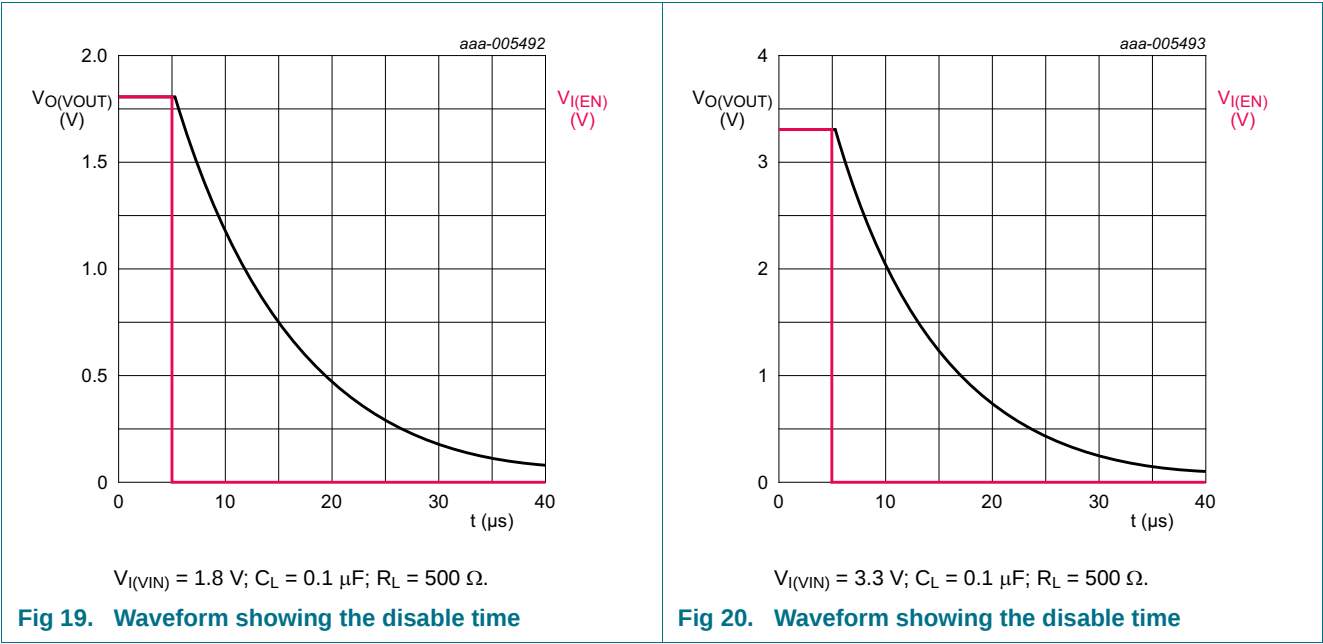
$V_{I(VIN)} = 1.8 \text{ V}$ ;  $C_L = 0.1 \text{ } \mu\text{F}$ ;  $R_L = 500 \text{ } \Omega$ .

Fig 17. Waveform showing the enable time

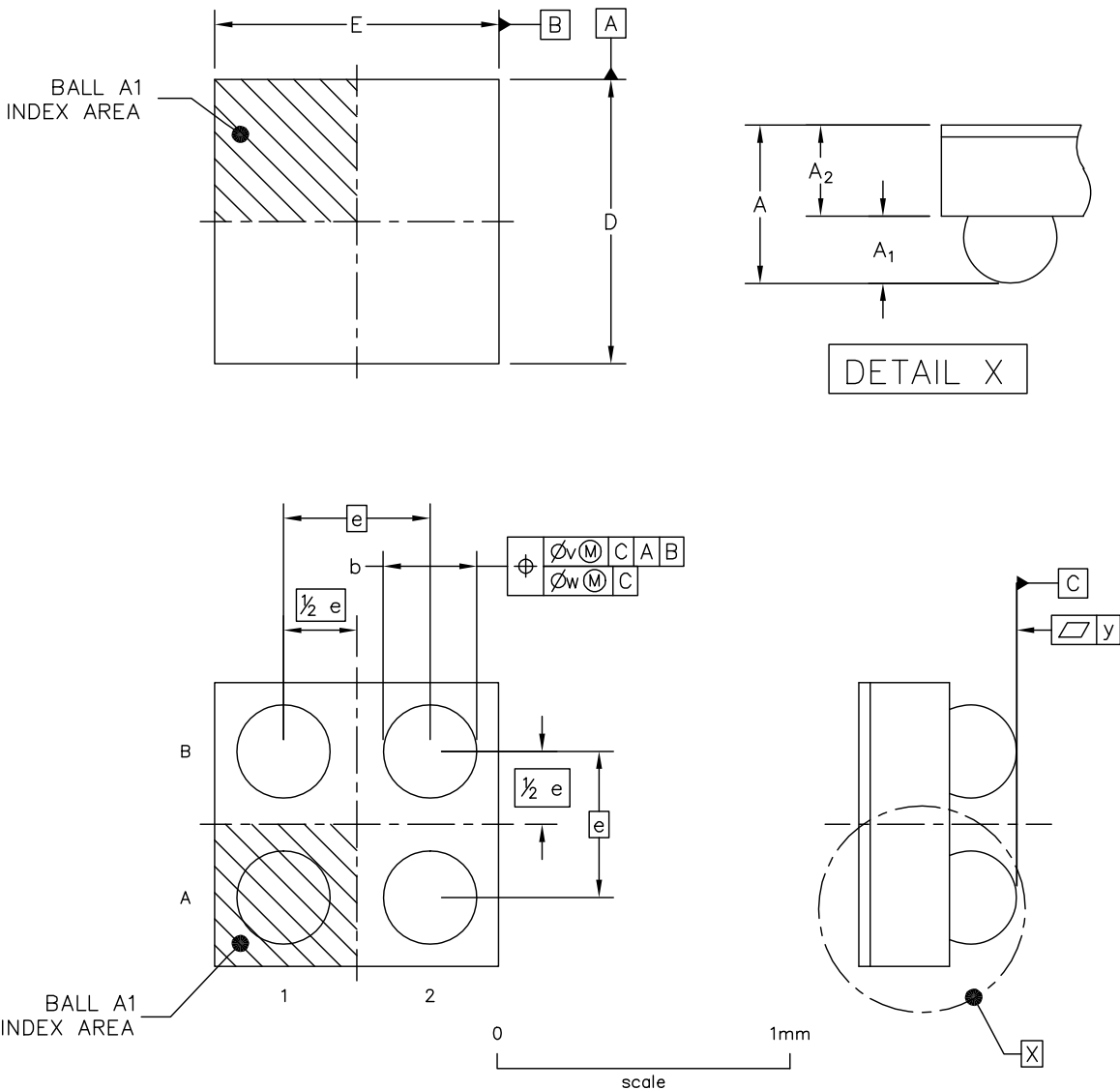


$V_{I(VIN)} = 3.3 \text{ V}$ ;  $C_L = 0.1 \text{ } \mu\text{F}$ ;  $R_L = 500 \text{ } \Omega$ .

Fig 18. Waveform showing the enable time



14. Package outline



DIMENSIONS (mm are the original dimensions)

| UNIT |     | A    | A <sub>1</sub> | A <sub>2</sub> | b    | D    | E    | e   | v    | w     | y    |
|------|-----|------|----------------|----------------|------|------|------|-----|------|-------|------|
| mm   | MAX | 0.58 | 0.26           | 0.335          | 0.35 | 1.00 | 1.00 |     |      |       |      |
|      | NOM | 0.54 | 0.23           | 0.310          | 0.32 | 0.97 | 0.97 | 0.5 | 0.02 | 0.015 | 0.03 |
|      | MIN | 0.50 | 0.20           | 0.285          | 0.29 | 0.94 | 0.94 |     |      |       |      |

NOTE: Backside coating 40 um

Fig 21. Package outline WLCSP4 (SOT1376-2)

## 15. Abbreviations

Table 13. Abbreviations

| Acronym | Description                                       |
|---------|---------------------------------------------------|
| CDM     | Charged Device Model                              |
| ESD     | ElectroStatic Discharge                           |
| HBM     | Human Body Model                                  |
| MOSFET  | Metal-Oxide Semiconductor Field Effect Transistor |

## 16. Revision history

Table 14. Revision history

| Document ID    | Release date                                                                                                                                                                            | Data sheet status  | Change notice | Supersedes   |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------|--------------|
| NX3P1108 v.2   | 20180620                                                                                                                                                                                | Product data sheet | 201804021F01  | NX3P1108 v.1 |
| Modifications: | <ul style="list-style-type: none"><li><a href="#">Figure 21 "Package outline WLCSP4 (SOT1376-2)"</a>: Parameter A1 min/nom/max changed from 0.21/0.24/0.27 to 0.20/0.23/0.26.</li></ul> |                    |               |              |
| NX3P1108 v.1   | 20130109                                                                                                                                                                                | Product data sheet | -             | -            |

## 17. Legal information

### 17.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | Definition                                                                            |
|-----------------------------------|-------------------------------|---------------------------------------------------------------------------------------|
| Objective [short] data sheet      | Development                   | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet    | Qualification                 | This document contains data from the preliminary specification.                       |
| Product [short] data sheet        | Production                    | This document contains the product specification.                                     |

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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