NX3P1108

Logic controlled high-side power switch

Rev. 2 — 20 June 2018 Product data sheet

1. General description

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

- 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

- 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

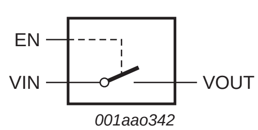


Fig 1. Logic symbol

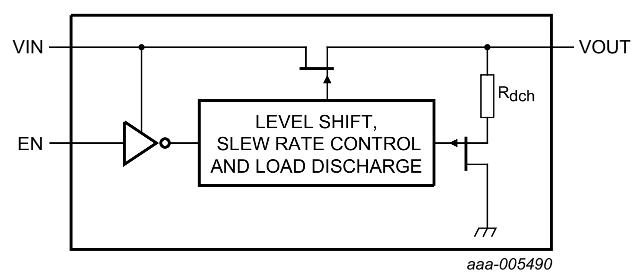


Fig 2. Logic diagram (simplified schematic)

7. Pinning information

7.1 Pinning

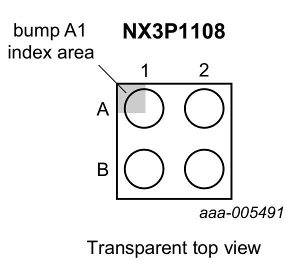


Fig 3. Pin configuration for WLCSP4

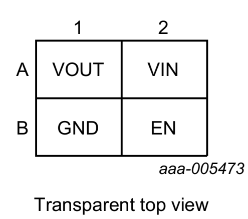


Fig 4. Ball mapping for WLCSP4

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[1]

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_I	input voltage	input EN	[1]	–0.5	+4.0	V
		input VIN	[2]	–0.5	+4.0	V
V_{SW}	switch voltage	output VOUT	[2]	–0.5	$V_{I(VIN)}$	V
I_{IK}	input clamping current	input EN: $V_{I(EN)} < -0.5$ V		–50	-	mA
I_{SK}	switch clamping current	input VIN: $V_{I(VIN)} < -0.5$ V		–50	-	mA
		output VOUT: $V_{O(VOUT)} < -0.5$ V		–50	-	mA
		output VOUT: $V_{O(VOUT)} > V_{I(VIN)} + 0.5$ V		-	50	mA
I_{SW}	switch current	$V_{SW} > -0.5$ V		-	±1500	mA
$T_{j(max)}$	maximum junction temperature			–40	+125	°C
T_{stg}	storage temperature			–65	+150	°C
P_{tot}	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 Tj. Higher power dissipation is allowed in conjunction with lower ambient temperatures. The conditions to determine the specified values are T_{amb} = 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		[1][2]	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

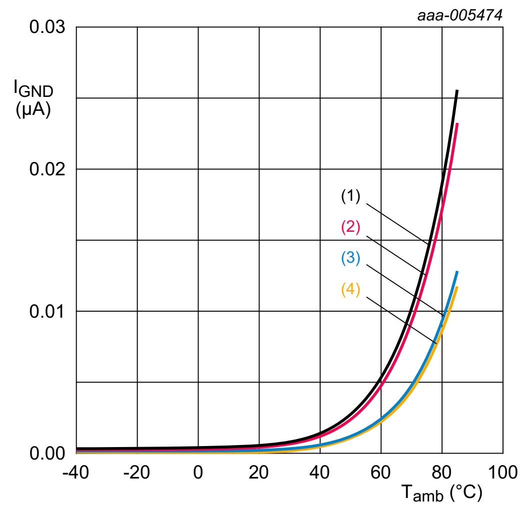
12. Static characteristics

Table 8. Static characteristics

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

Symbol	Parameter	Conditions		T_{amb} = 25 °C			T_{amb} = –40 °C to +85 °C		Unit
				Min	Typ	Max	Min	Max	
V_{IH}	HIGH-level input voltage	EN input							
		$V_{I(VIN)}$ = 0.9 V to 1.1 V		-	-	-	0.8	-	V
		$V_{I(VIN)}$ = 1.1 V to 1.3 V		-	-	-	1.0	-	V
		$V_{I(VIN)}$ = 1.3 V to 1.8 V		-	-	-	1.1	-	V
		$V_{I(VIN)}$ = 1.8 V to 3.6 V		-	-	-	1.1	-	V
V_{IL}	LOW-level input voltage	EN input							
		$V_{I(VIN)}$ = 0.9 V to 1.1 V		-	-	-	-	0.2	V
		$V_{I(VIN)}$ = 1.1 V to 1.3 V		-	-	-	-	0.3	V
		$V_{I(VIN)}$ = 1.3 V to 1.8 V		-	-	-	-	0.4	V
		$V_{I(VIN)}$ = 1.8 V to 3.6 V		-	-	-	-	0.45	V
I_I	input leakage current	$V_{I(EN)}$ = 0 V or 3.6 V		-	0.1	-	-	1	μA
I_{GND}	ground current	$V_{I(EN)}$ = 0 V or 3.6 V; VOUT open; see Figure 5 and Figure 6		-	-	-	–2	-	μA
$I_{S(OFF)}$	OFF-state leakage current	$V_{I(VIN)}$ = 3.6 V; $V_{I(EN)}$ = GND; $V_{I(VOUT)}$ = GND; see Figure 10 and Figure 11		-	0.1	-	-	2.0	μA
R_{dch}	discharge resistance	VOUT output; $V_{I(VIN)}$ = 3.3 V		-	120	-	-	-	Ω

12.1 Graphs



$V_{I(EN)} = V_{I(VIN)}$.

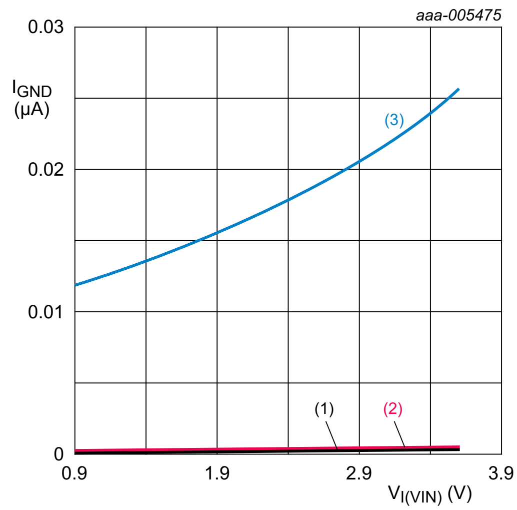
(1) $V_{I(VIN)}$ = 3.6 V.

(2) $V_{I(VIN)}$ = 3.3 V.

(3) $V_{I(VIN)}$ = 1.2 V.

(4) $V_{I(VIN)}$ = 0.9 V.

Fig 5. Waveform showing the ground current versus temperature



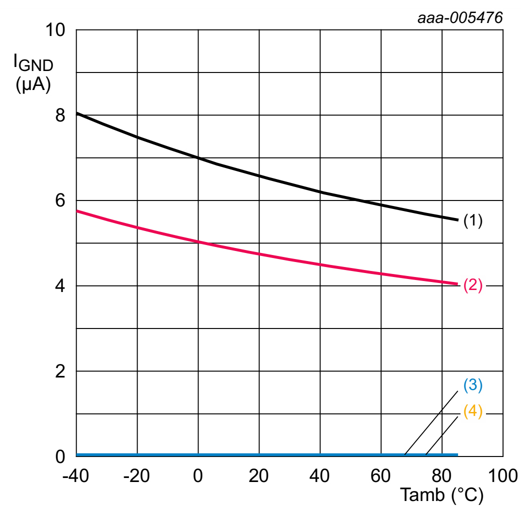
$V_{I(EN)} = V_{I(VIN)}$.

(1) T_{amb} = −40 °C.

(2) T_{amb} = 25 °C.

(3) T_{amb} = 85 °C.

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



$V_{I(EN)}$ = 1.2 V

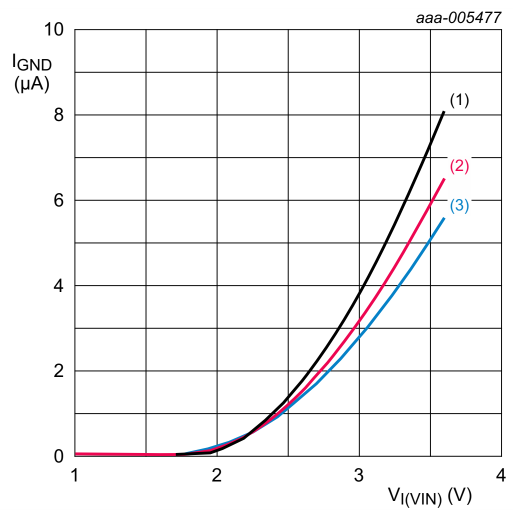
(1) $V_{I(VIN)}$ = 3.6 V.

(2) $V_{I(VIN)}$ = 3.3 V.

(3) $V_{I(VIN)}$ = 1.2 V.

(4) $V_{I(VIN)}$ = 0.9 V.

Fig 7. Waveform showing the ground current versus temperature



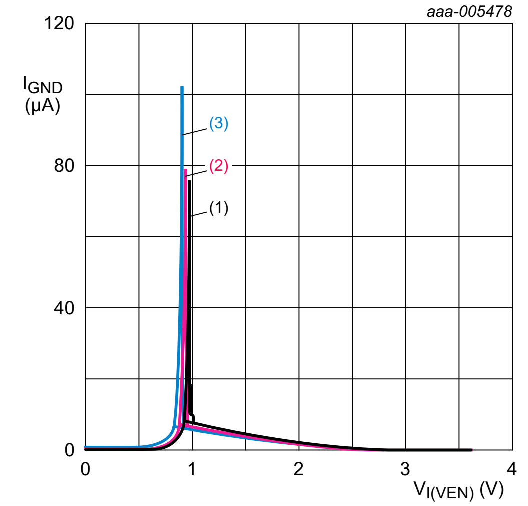
$V_{I(EN)}$ = 1.2 V

(1) T_{amb} = −40 °C.

(2) T_{amb} = 85 °C.

(3) T_{amb} = 25 °C.

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

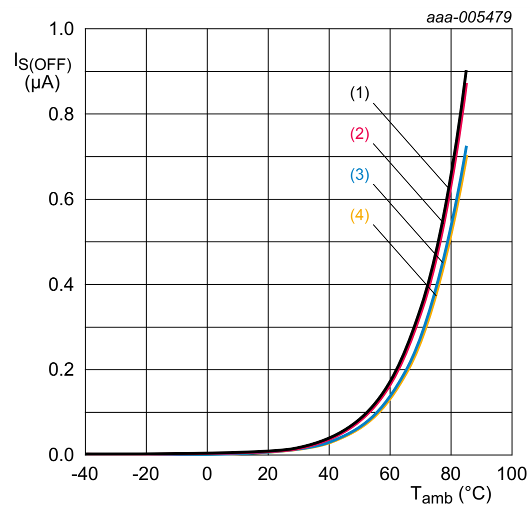


(1) T_{amb} = −40 °C.

(2) T_{amb} = 85 °C.

(3) T_{amb} = 25 °C.

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



$V_{I(EN)}$ = GND.

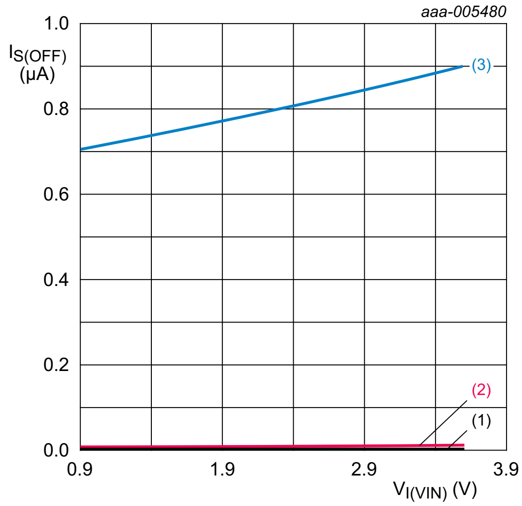
(1) $V_{I(VIN)}$ = 3.6 V.

(2) $V_{I(VIN)}$ = 3.3 V.

(3) $V_{I(VIN)}$ = 1.2 V.

(4) $V_{I(VIN)}$ = 0.9 V.

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



(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 85 °C.

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

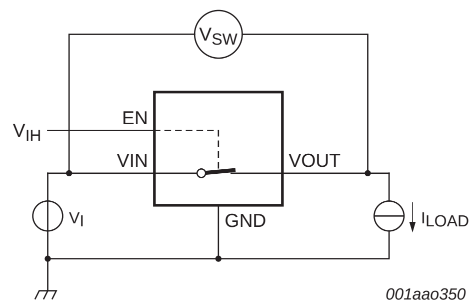
12.2 ON resistance

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

Symbol	Parameter	Conditions	T_{amb} = −40 °C to +85 °C			Unit
			Min	Typ[1]	Max	
R_{ON}	ON resistance	$V_{I(EN)} = V_{I(VIN)}$; I_{LOAD} = 200 mA; see Figure 12, Figure 13 and Figure 14				
		$V_{I(VIN)}$ = 0.9 V	-	105	140	mΩ
		$V_{I(VIN)}$ = 1.2 V	-	68	81	mΩ
		$V_{I(VIN)}$ = 1.5 V	-	55	65	mΩ
		$V_{I(VIN)}$ = 1.8 V	-	50	55	mΩ
		$V_{I(VIN)}$ = 2.5 V	-	40	44	mΩ
		$V_{I(VIN)}$ = 3.3 V	-	34	40	mΩ

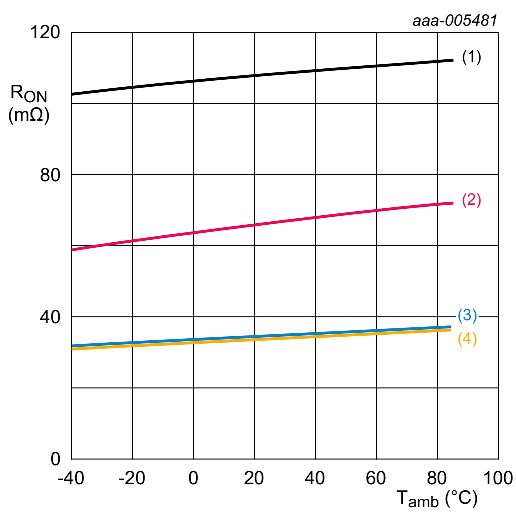
[1] Typical values are measured at T_{amb} = 25 °C.

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 mA.

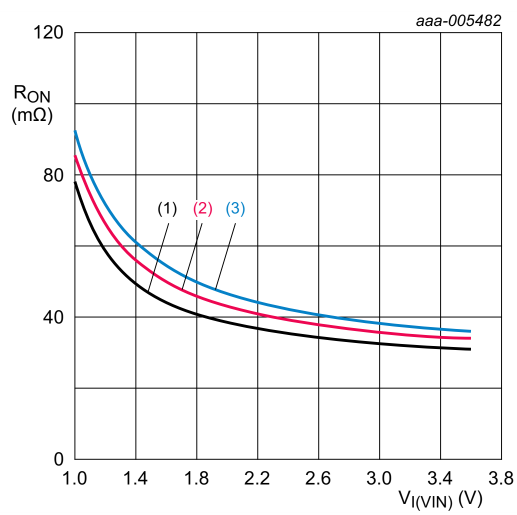
(1) $V_{I(VIN)}$ = 0.9 V.

(2) $V_{I(VIN)}$ = 1.2 V.

(3) $V_{I(VIN)}$ = 3.3 V.

(4) $V_{I(VIN)}$ = 3.6 V.

Fig 13. Waveform showing the ON resistance versus temperature



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

(1) T_{amb} = −40 °C.

(2) T_{amb} = 25 °C.

(3) T_{amb} = 85 °C.

Fig 14. Waveform showing the ON resistance versus input voltage

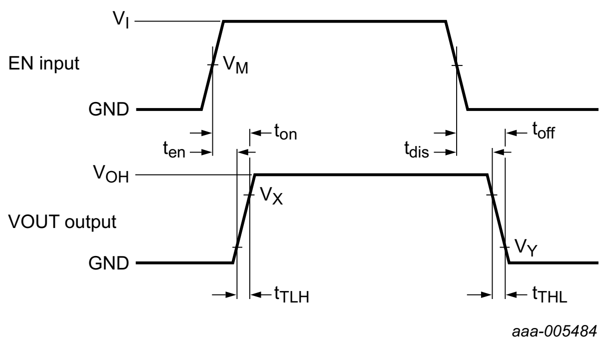
13. Dynamic characteristics

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 °C			Unit
			Min	Typ	Max	
t_{en}	enable time	EN to VOUT; see Figure 15				
		$V_{I(VIN)}$ = 1.8 V	-	120	-	µs
		$V_{I(VIN)}$ = 3.3 V	-	70	-	µs
t_{dis}	disable time	EN to VOUT; see Figure 15				
		$V_{I(VIN)}$ = 1.8 V	-	1.5	-	µs
		$V_{I(VIN)}$ = 3.3 V	-	1.5	-	µs
t_{on}	turn-on time	EN to VOUT; see Figure 15				
		$V_{I(VIN)}$ = 1.8 V	-	220	-	µs
		$V_{I(VIN)}$ = 3.3 V	-	150	-	µs
t_{off}	turn-off time	EN to VOUT; see Figure 15				
		$V_{I(VIN)}$ = 1.8 V	-	25	-	µs
		$V_{I(VIN)}$ = 3.3 V	-	22.5	-	µs
t_{TLH}	LOW to HIGH output transition time	VOUT; see Figure 15				
		$V_{I(VIN)}$ = 1.8 V	-	100	-	µs
		$V_{I(VIN)}$ = 3.3 V	-	80	-	µs
t_{THL}	HIGH to LOW output transition time	VOUT; see Figure 15				
		$V_{I(VIN)}$ = 1.8 V	-	23.5	-	µs
		$V_{I(VIN)}$ = 3.3 V	-	21	-	µs

13.1 Waveform and test circuits



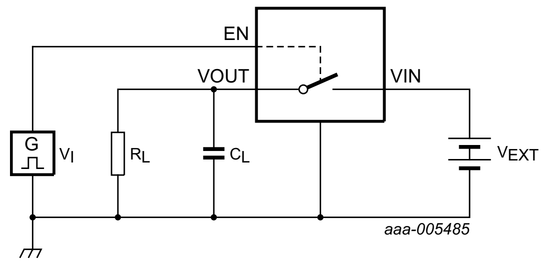
Measurement points are given in Table 11.

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.

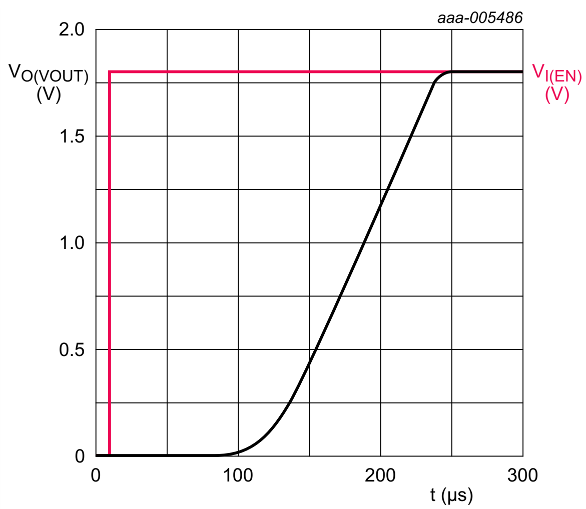
C_L = Load capacitance including jig and probe capacitance.

V_{EXT} = External voltage for measuring switching times.

Fig 16. Test circuit for measuring switching times

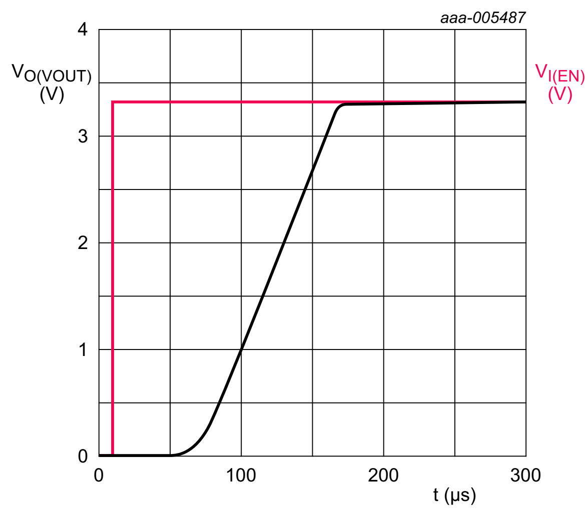
Table 12. Test data

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 μF	500 Ω



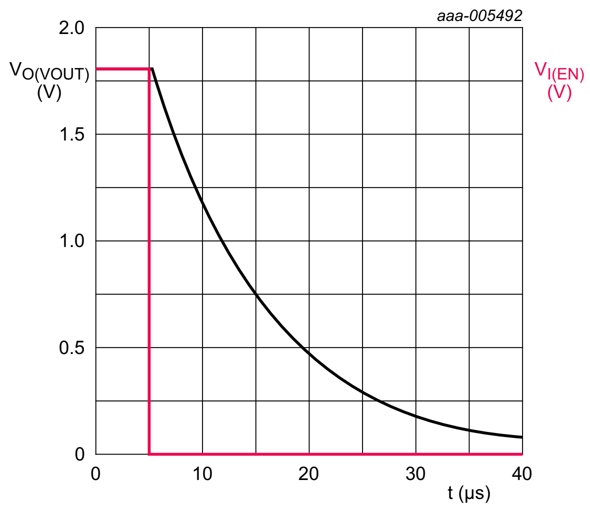
$V_{I(VIN)}$ = 1.8 V; C_L = 0.1 μF; R_L = 500 Ω.

Fig 17. Waveform showing the enable time



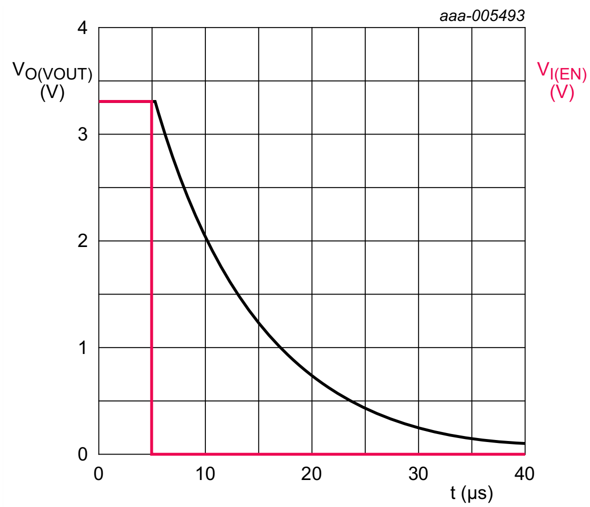
$V_{I(VIN)}$ = 3.3 V; C_L = 0.1 μF; R_L = 500 Ω.

Fig 18. Waveform showing the enable time



$V_{I(VIN)}$ = 1.8 V; C_L = 0.1 μF; R_L = 500 Ω.

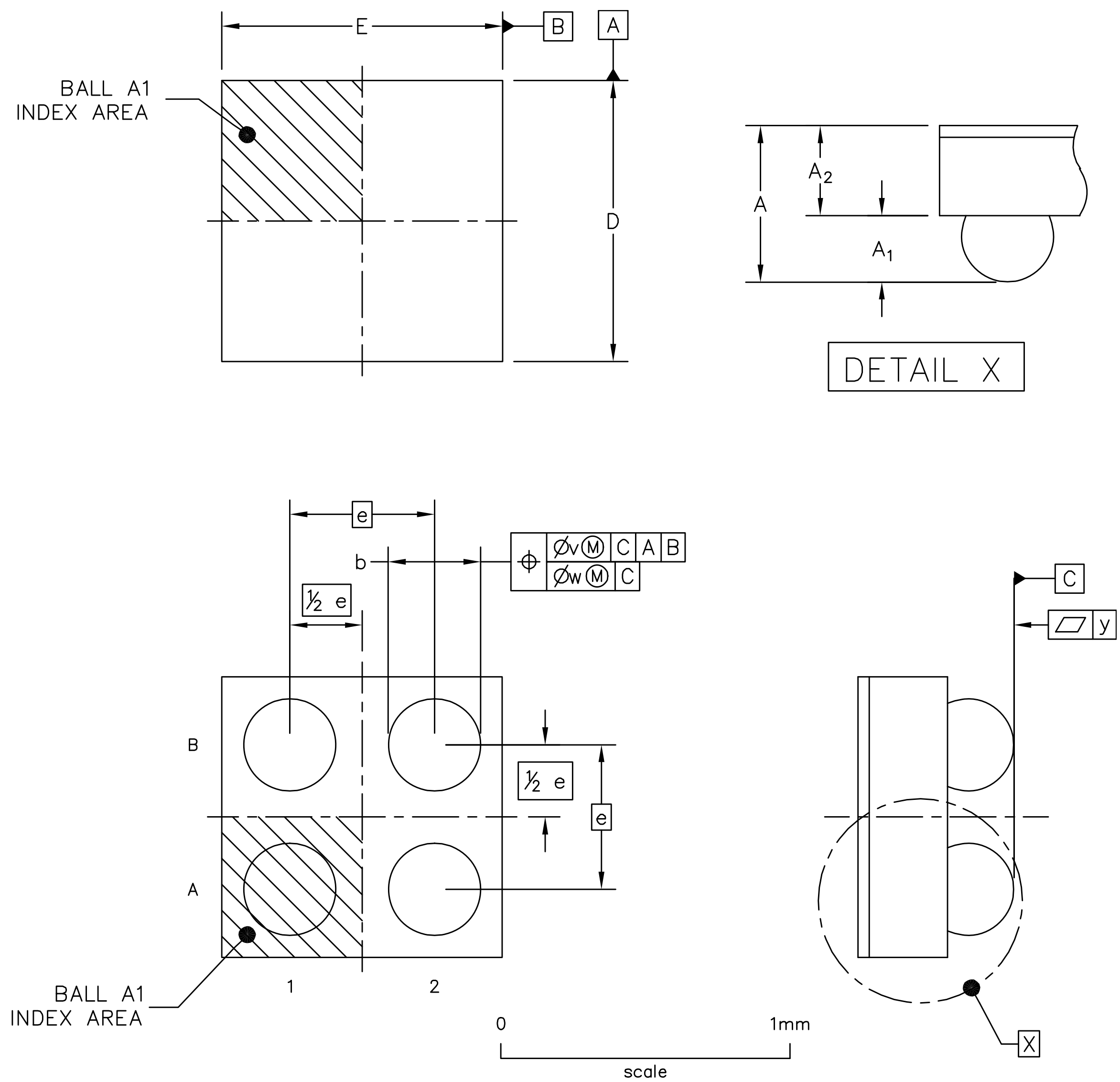
Fig 19. Waveform showing the disable time



$V_{I(VIN)}$ = 3.3 V; C_L = 0.1 μF; R_L = 500 Ω.

Fig 20. Waveform showing the disable time

14. Package outline



DIMENSIONS (mm are the original dimensions)

UNIT		A	A_1	A_2	b	D	E	e	v	w	y
mm	MAX	0.58	0.26	0.335	0.35	1.00	1.00	0.5	0.02	0.015	0.03
	NOM	0.54	0.23	0.310	0.32	0.97	0.97				
	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:	• Figure 21 “Package outline WLCSP4 (SOT1376-2)”: Parameter A1 min/nom/max changed from 0.21/0.24/0.27 to 0.20/0.23/0.26.			
NX3P1108 v.1	20130109	Product data sheet	-	-

17. Legal information

17.1 Data sheet status

Document status[1][2]	Product status[3]	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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18. Contact information

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