NX3P2902B

Logic controlled high-side power switch Rev. 2 — 22 February 2018

Product data sheet

1. General description

The NX3P2902B is a high-side load switch which features a low ON resistance P-channel MOSFET. The MOSFET supports more than 500 mA of continuous current and an integrated output discharge resistor to discharge the output capacitance when disabled. Designed for operation from 1.1 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 NX3P2902B is ideal for portable, battery operated applications due to low ground current and OFF-state current.

2. **Features and benefits**

- Wide supply voltage range from 1.1 V to 3.6 V
- Very low ON resistance:
 - 95 mΩ at a supply voltage of 1.8 V
- High noise immunity
- Low OFF-state leakage current (600 nA maximum)
- 1.2 V control logic at a supply voltage of 3.6 V
- High current handling capability (500 mA 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



Logic controlled high-side power switch

4. Ordering information

Table 1. Ordering information

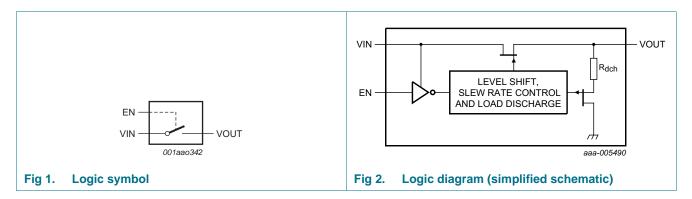
Type number	Topside	Package				
marking		Name	Description	Version		
NX3P2902BUK	x2		wafer level chip-scale package; 4 bumps; $0.77 \times 0.77 \times 0.51$ mm. (Backside coating included)	NX3P2902B		

4.1 Ordering options

Table 2. Ordering options

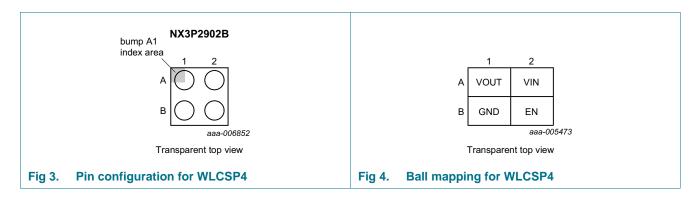
Type number	Orderable part number	Package	J	Minimum order quantity	Temperature
NX3P2902BUK	NX3P2902BUKZ	WLCSP4	Reel 7" Q1/T1 in Drypack	3000	$T_{amb} = -40 ^{\circ}\text{C} \text{ to } +85 ^{\circ}\text{C}$

5. Functional diagram



6. Pinning information

6.1 Pinning



Logic controlled high-side power switch

6.2 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)

7. Functional description

Table 4. Function table[1]

Input EN	Switch
L	switch OFF
Н	switch ON

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

8. 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	I	Min	Max	Unit
VI	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	$V_{SW} > -0.5 \text{ V}$				
		T _{amb} = 25 °C	-	-	±1000	mA
		T _{amb} = 85 °C	-	-	±500	mA
T _{j(max)}	maximum junction temperature		-	-40	+125	°C
T _{stg}	storage temperature		-	-65	+150	°C
P _{tot}	total power dissipation	<u>r</u>	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_j . 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.

9. Recommended operating conditions

Table 6. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V_{I}	input voltage		1.1	3.6	V
T _{amb}	ambient temperature		-40	+85	°C

10. Thermal characteristics

Table 7. Thermal characteristics

Symbol	Parameter	Conditions	Тур	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	[1][2]	130	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 e.g. to the power and ground layer. In multi-layer PCB applications, the second layer should be used to create a large heat spreader area right below the device. If this layer is either ground or power, it should be connected with several vias to the top layer connecting 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 the application. The actual R_{th(j-a)} value may vary in applications using different layer stacks and layouts.

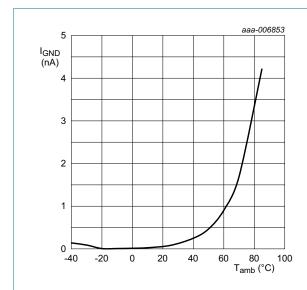
11. Static characteristics

Table 8. Static characteristics

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

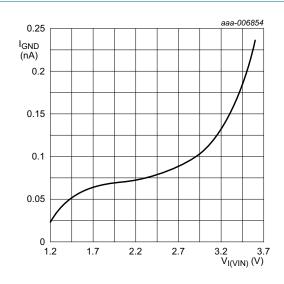
Symbol	Parameter	Conditions	Tar	_{nb} = 25	°C	T_{amb} = -40 °C to +85 °C		Unit
			Min	Тур	Max	Min	Max	
V_{IH}	HIGH-level	EN input						
	input voltage	V _{I(VIN)} = 1.1 V to 1.3 V	-	-	-	1.0	-	V
		V _{I(VIN)} = 1.3 V to 1.8 V	-	-	-	1.2	-	V
		V _{I(VIN)} = 1.8 V to 3.6 V	-	-	-	1.2	-	V
V_{IL}	LOW-level	EN input						
	input voltage	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
II	input leakage current	$V_{I(EN)} = 0 \text{ V or } 3.6 \text{ V}$	-	0.1	-	-	500	nA
I _{GND}	ground current	$V_{I(EN)} = 0 \text{ V or } 3.6 \text{ V; VOUT open;}$ see <u>Figure 5</u> and <u>Figure 6</u>	-	-	-	-2	-	μΑ
I _{S(OFF)}	OFF-state leakage current	$V_{I(VIN)} = 3.6 \text{ V}; V_{I(EN)} = \text{GND};$ $V_{I(VOUT)} = \text{GND}; \text{ see } \frac{\text{Figure 8}}{\text{Figure 8}}$	-	10	-	-	600	nA
R _{dch}	discharge resistance	VOUT output; V _{I(VIN)} = 3.3 V	-	90	-	-	120	Ω

11.1 Graphs



 $V_{I(VIN)} = 1.8 \text{ V}; V_{I(EN)} = 1.8 \text{ V}; I_{LOAD} = 500 \text{ mA}.$

Fig 5. Ground current versus temperature



 $V_{I(EN)} = V_{I(VIN)}$; $T_{amb} = 25$ °C; $I_{LOAD} = 500$ mA.

Fig 6. Ground current versus input voltage on pin VIN

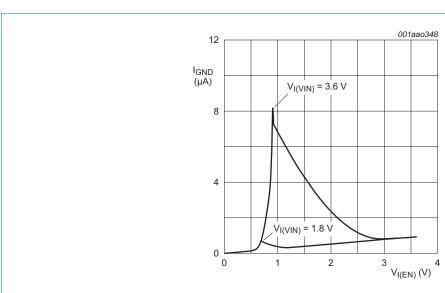
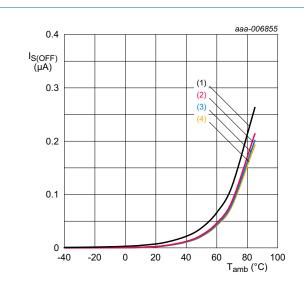


Fig 7. Additional ground current versus input voltage



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

- (1) $V_{I(VIN)} = 3.6 \text{ V}.$
- (2) $V_{I(VIN)} = 2.5 \text{ V}.$
- (3) $V_{I(VIN)} = 1.8 \text{ V}.$
- (4) $V_{I(VIN)} = 1.2 \text{ V}.$

Fig 8. OFF-state leakage current versus temperature

11.2 ON resistance

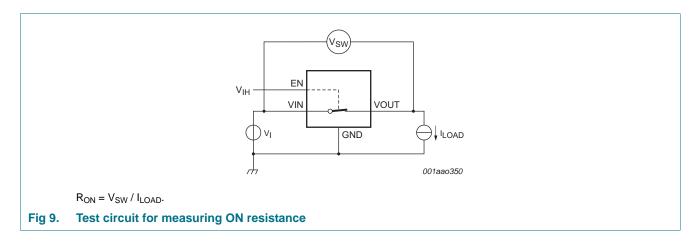
Table 9. ON resistance

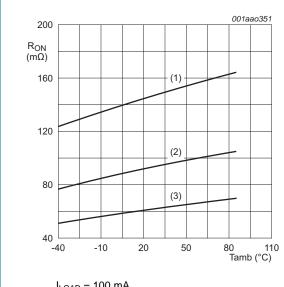
At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	eter Conditions	T _{amb}	T_{amb} = -40 °C to +85 °C			
			Min	Typ[1]	Max		
R _{ON}	ON resistance	$V_{I(EN)}$ = 1.5 V; I_{LOAD} = 200 mA; see <u>Figure 9</u> , <u>Figure 10</u> and <u>Figure 11</u>					
		V _{I(VIN)} = 1.2 V	-	150	-	mΩ	
		V _{I(VIN)} = 1.5 V	-	110	-	mΩ	
		V _{I(VIN)} = 1.8 V	-	95	130	mΩ	
		$V_{I(VIN)} = 2.5 \text{ V}$	-	75	-	mΩ	
		V _{I(VIN)} = 3.6 V	-	65	-	mΩ	

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

11.3 ON resistance test circuit and waveforms

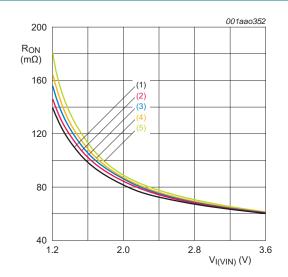






- (1) $V_{I(VIN)} = 1.2 \text{ V}.$
- (2) $V_{I(VIN)} = 1.8 \text{ V}.$
- (3) $V_{I(VIN)} = 3.6 \text{ V}.$

Fig 10. ON resistance versus temperature



 $V_{I(EN)} = V_{I(VIN)}$; $T_{amb} = 25 \, ^{\circ}C$.

- (1) $I_{LOAD} = 10 \text{ mA}.$
- (2) $I_{LOAD} = 100 \text{ mA}.$
- (3) $I_{LOAD} = 250 \text{ mA}.$
- (4) $I_{LOAD} = 350 \text{ mA}.$
- (5) $I_{LOAD} = 500 \text{ mA}.$

Fig 11. ON resistance versus input voltage

12. Dynamic characteristics

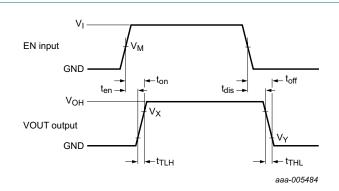
Table 10. Dynamic characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for test circuit see <u>Figure 12</u> and <u>Figure 13</u>.

Symbol	Parameter	Conditions	T_{amb} = -40 °C to +85 °C			
			Min	Typ[1]	Max	
t _{en}	enable time	EN to VOUT; see Figure 14				
		V _{I(VIN)} = 1.8 V	175	310	-	μS
		V _{I(VIN)} = 3.3 V	80	135	-	μS
t _{dis}	disable time	EN to VOUT; see Figure 14				
		V _{I(VIN)} = 1.8 V	-	10	-	μS
		V _{I(VIN)} = 3.3 V	-	8	-	μS
t _{on}	turn-on time	EN to VOUT; see Figure 14 and Figure 15				
		V _{I(VIN)} = 1.8 V	285	570	-	μS
		V _{I(VIN)} = 3.3 V	150	280	-	μS
t _{off}	turn-off time	EN to VOUT; see Figure 16 and Figure 17				
		V _{I(VIN)} = 1.8 V	-	200	-	μS
		V _{I(VIN)} = 3.3 V	-	180	-	μS
t _{TLH}	LOW to HIGH	VOUT				
	output transition	V _{I(VIN)} = 1.8 V	110	265	-	μS
	time	V _{I(VIN)} = 3.3 V	70	150	-	μS
t _{THL}	HIGH to LOW	VOUT				
	output	V _{I(VIN)} = 1.8 V	-	190	-	μS
	transition time	V _{I(VIN)} = 3.3 V	-	172	-	μS

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

12.1 Waveforms and test circuits



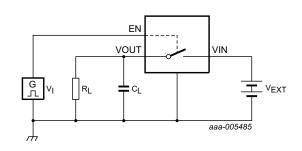
Measurement points are given in Table 11.

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

Fig 12. Switching times

Table 11. Measurement points

Supply voltage	EN Input		Output			
V _{I(VIN)}	V _M	t _r , t _f	V _M	V _X	V _Y	
1.1 V to 3.6 V	$0.5 \times V_{I(EN)}$	≤ 100 ns	$0.5 \times V_{OH}$	$0.9 \times V_{OH}$	0.1 × V _{OH}	



Test data is given in Table 12.

Definitions test circuit:

R_L = Load resistance.

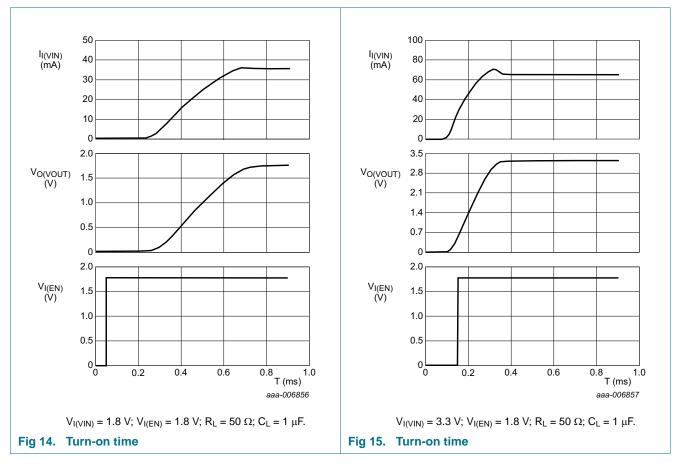
 C_L = Load capacitance including jig and probe capacitance.

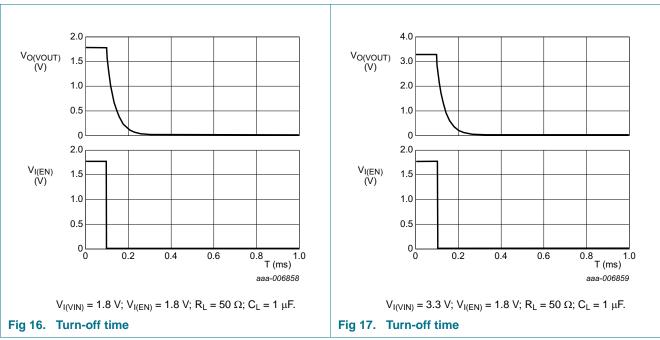
 V_{EXT} = External voltage for measuring switching times.

Fig 13. Test circuit for measuring switching times

Table 12. Test data

Supply voltage	EN Input	Load	
V _{EXT}	V _{I(EN)}	C _L	R_L
1.1 V to 3.6 V	1.8 V	1 μF	500 Ω





13. Package outline

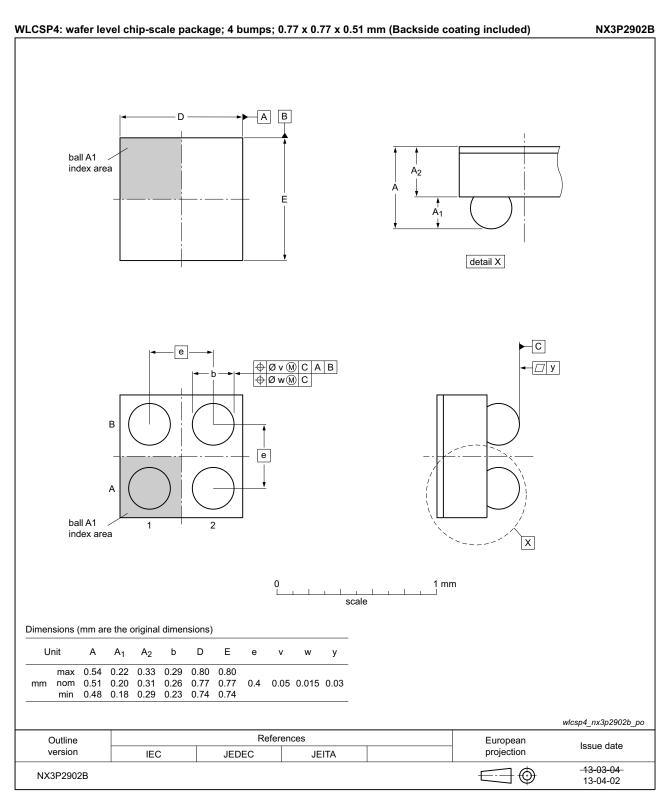


Fig 18. Package outline WLCSP4 (NX3P2902B)



Logic controlled high-side power switch

14. Abbreviations

Table 13. Abbreviations

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

15. Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes	
NX3P2902B v.2	20180222	Product data sheet	-	NX3P2902B v.1.1	
Modifications:	 Updated <u>Secti</u> 	on 4 "Ordering information"			
NX3P2902B v.1.1	20161101	Product data sheet	-	NX3P2902B v.1	
Modifications:	<u>Table 8</u> : Updated OFF-state current specification				
NX3P2902B v.1	20130429	Product data sheet	-	-	

NXP Semiconductors NX3P2902B

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Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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Logic controlled high-side power switch

18. Contents

1	General description 1
2	Features and benefits
3	Applications
4	Ordering information 2
4.1	Ordering options
5	Functional diagram 2
6	Pinning information
6.1	Pinning
6.2	Pin description
7	Functional description 3
8	Limiting values 3
9	Recommended operating conditions 4
10	Thermal characteristics 4
11	Static characteristics 4
11.1	Graphs
11.2	ON resistance
11.3	ON resistance test circuit and waveforms 7
12	Dynamic characteristics 8
12.1	Waveforms and test circuits 9
13	Package outline
14	Abbreviations 12
15	Revision history 12
16	Legal information
16.1	Data sheet status
16.2	Definitions
16.3	Disclaimers
16.4	Trademarks14
17	Contact information 14
18	Contents

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