

## SPICE Modeling Report

# 1ch High-Side Switch IC

# BD1Hx500 Series

In this report, the characteristics from the SPICE simulation model of the 1ch High-Side Switch IC BD1Hx500 Series will be described.

### Simulation Environment

- Circuit Simulator : PSpice / Cadence Design System, Inc.
- Version Information : 17.2-2016
- OS Information : Windows 10 64-bit Edition

### File Information

- Library File Name : BD1Hx500.lib
- Symbol File Name : BD1Hx500.olb
- Subcircuit and Symbol

Table 1. Correspondence Table

Product Name	Subcircuit	Symbol
BD1HC500EFJ-C	BD1Hx500 (Rev:1.00)	BD1Hx500
BD1HC500HFN-C		
BD1HC500FVM-C		
BD1HD500EFJ-C		
BD1HD500HFN-C		
BD1HD500FVM-C		

### BD1Hx500 SPICE MODEL

- Terminal Information

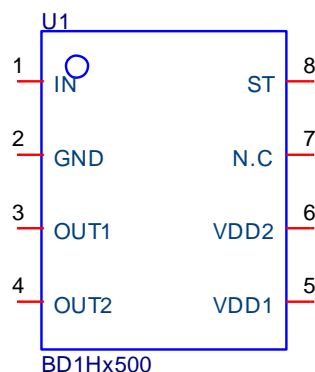


Figure 1. Symbol of BD1Hx500

Table 2. Pin Table

Terminal No.	Terminal Name
1	IN
2	GND
3	OUT1 (Note1)
4	OUT2 (Note1)
5	VDD1 (Note2)
6	VDD2 (Note2)
7	N.C
8	ST

### Verifiable Characteristics

- Electrical Characteristics (vs. Datasheet).....2
- Timing Chart.....3
- Characteristics Data (vs. Measured Waveform)
  - ✓ Output On Resistance.....4
  - ✓ Standby Current.....5
  - ✓ Input Current.....6

(Note 1) OUT1 and OUT2 are shorted inside the IC.

(Note 2) VDD1 and VDD2 are shorted inside the IC.

(Note 3) This model is not compatible with the influence of ambient temperature.

(Note 4) Please use the simulation results only as a design guide and the data reported herein is not a guaranteed value.

Moreover, the characteristics which are not included in the report may change depending on the actual board design and ROHM strongly recommend to double check those characteristics with actual board where the chips will be mounted on.

## Electrical Characteristics (vs. Datasheet)

Table 3. Electrical Characteristics Comparison

(Unless otherwise specified,  $V_{DD}=4V$  to  $18V$ )

Parameter		Modeled <i>(Note 1)</i>	Value		Unit	Error	Condition
			Datasheet	SPICE			
[Power Supply Block]							
Standby Current		✓	0.1	0.10	μA	0.0%	V <sub>DD</sub> =12V, V <sub>IN</sub> =0V, V <sub>OUT</sub> =0V
Operating Current		✓	1.5	1.52	mA	1.3%	V <sub>DD</sub> =12V, V <sub>IN</sub> =5V, V <sub>OUT</sub> =open
Under Voltage Lock Out (UVLO) Threshold		✓	3.0	3.00	V	0.0%	
[Input Block]							
H Level Input Voltage		✓	-	2.15	V	-	
L Level Input Voltage		✓	-	1.85	V	-	
Input Hysteresis		✓	0.3	0.30	V	0.0%	
H Level Input Current		✓	50	50.0	μA	0.0%	V <sub>IN</sub> =5V
L Level Input Current		✓	-	0.0	μA	-	V <sub>IN</sub> =0V
[Power MOS Output]							
Output On Resistance		✓	500	499.9	mΩ	0.0%	V <sub>DD</sub> =12V, I <sub>OUT</sub> =0.25A
Output Leak Current		✓	-	0.0	μA	-	V <sub>IN</sub> =0V
Switching Time	On	✓	13	13.0	μs	0.0%	V <sub>DD</sub> =12V, R <sub>L</sub> =47Ω
	Off	✓	9	9.0	μs	0.0%	V <sub>DD</sub> =12V, R <sub>L</sub> =47Ω
Slew Rate On		✓	3	3.0	V/μs	0.0%	V <sub>DD</sub> =12V, R <sub>L</sub> =47Ω
Slew Rate Off		✓	3	3.0	V/μs	0.0%	V <sub>DD</sub> =12V, R <sub>L</sub> =47Ω
Output Clamp Voltage		✓	-6.0	-6.05	V	0.8%	V <sub>IN</sub> =0V, I <sub>OUT</sub> =100mA
[Diagnostic Output]							
Diagnostic Output Voltage		✓	-	0.08	V	-	V <sub>IN</sub> =5V, I <sub>ST</sub> =0.1mA
Diagnostic Output Current		✓	-	0.0	μA	-	V <sub>IN</sub> =0V, V <sub>ST</sub> =12V
[Protect Circuit]							
Overcurrent Protection		✓	1.45	1.460	A	0.7%	
Diagnostic Output Delay Time (OCP)	On	✓	20	21.5	μs	7.5%	Diagnostic Output Delay Time (OCP)
	Off	✓	100	106.0	μs	6.0%	V <sub>DD</sub> =12V, R <sub>L</sub> =∞ to 4Ω
Open Load Detection Threshold		✓	2.8	2.83	V	1.1%	V <sub>IN</sub> =0V
Open Load Detection Delay Time		✓	300	335.0	μs	11.7%	V <sub>IN</sub> =5V to 0V

(Note 1) ✓: Model available (supported), X: Model not available" (not supported).

## Timing Chart

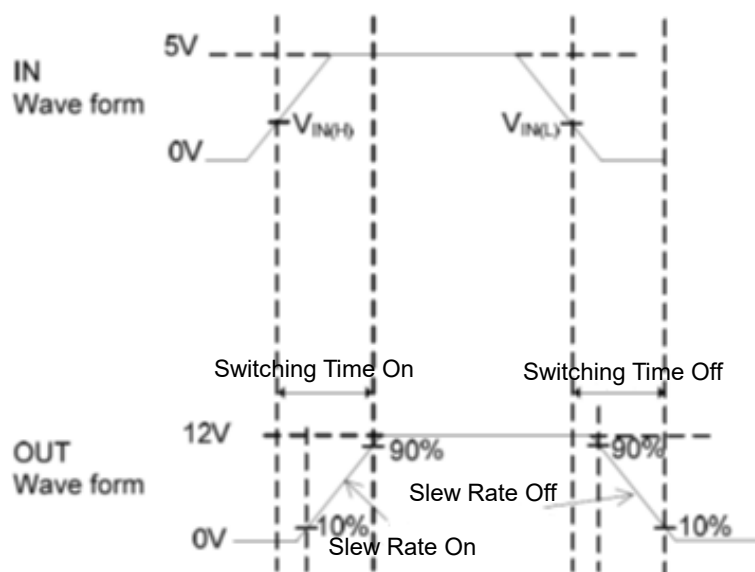


Figure 2. Switching Time

Characteristic Data (vs. Measured Waveform)  
1. Output On Resistance Characteristic

Simulation Setting  
Type: DC  
Voltage Source: VDD  
(4V to 18V, 0.1Vstep)

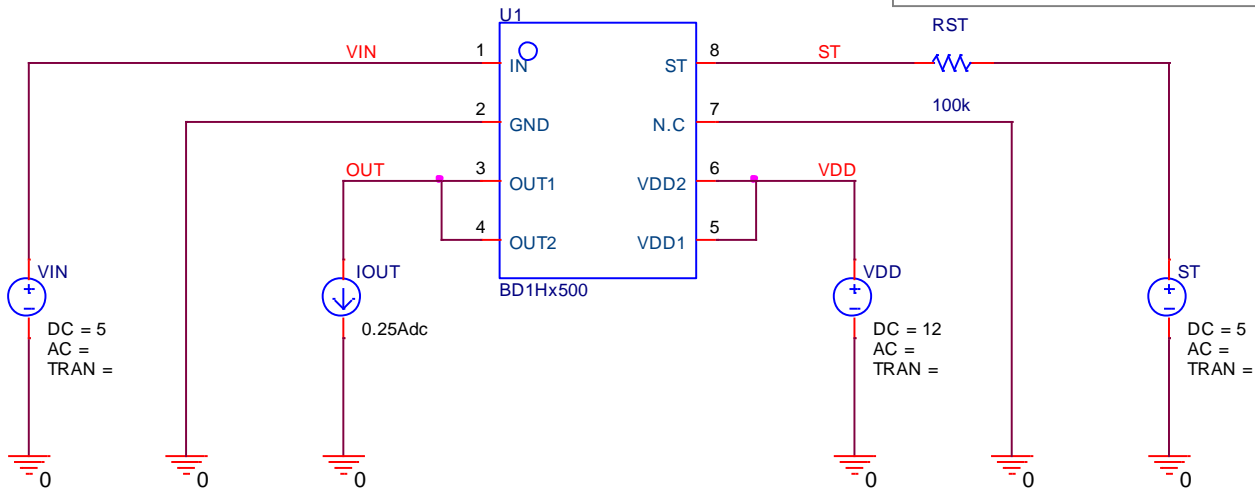


Figure 3.  
Simulation Schematic 1.

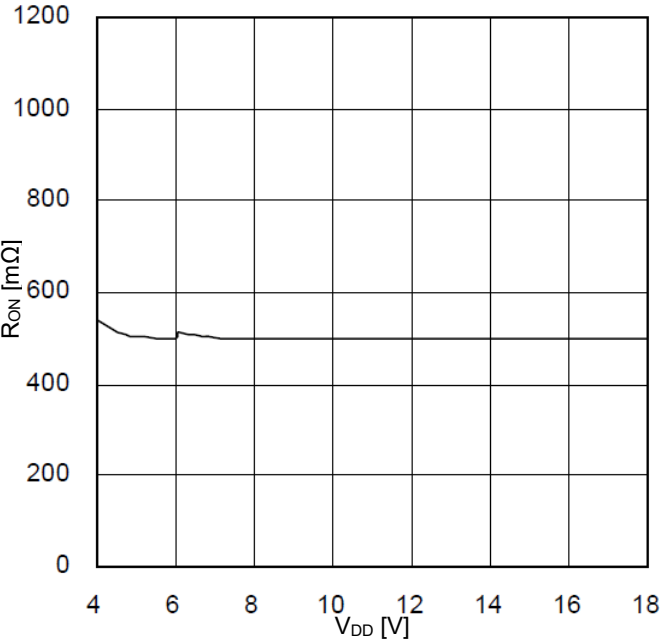


Figure 4.  
Output On Resistance  
(Measured Waveform)

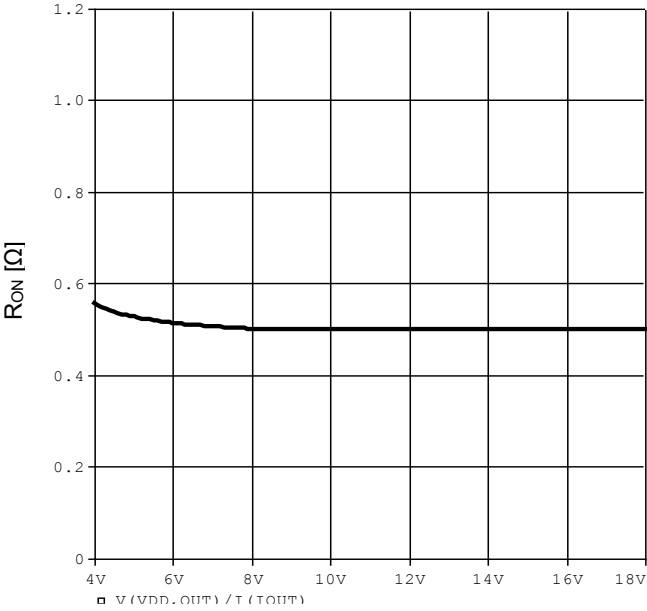


Figure 5.  
Output On Resistance  
(SPICE Simulation)

Table 4. Comparison of Characteristics

(Unless otherwise specified, V<sub>DD</sub>=12V, V<sub>IN</sub>=5V)

Parameter	Measured Result	SPICE Simulation Result	Unit	Error	Condition
Output ON Resistance	500	499.9	mΩ	0.0%	V <sub>DD</sub> =12V, I <sub>OUT</sub> =0.25A

(Note 1) The above data is based on a specific sample and it is not meant to be a guaranteed value.

2. Standby Current

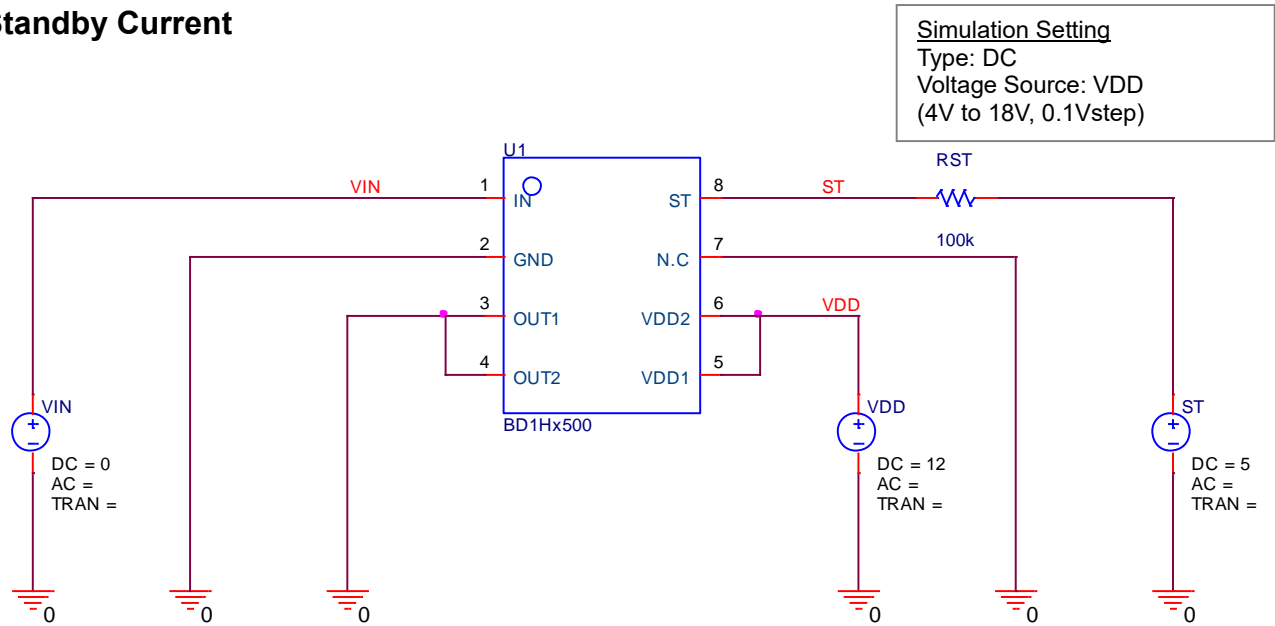


Figure 6.  
Simulation Schematic 2

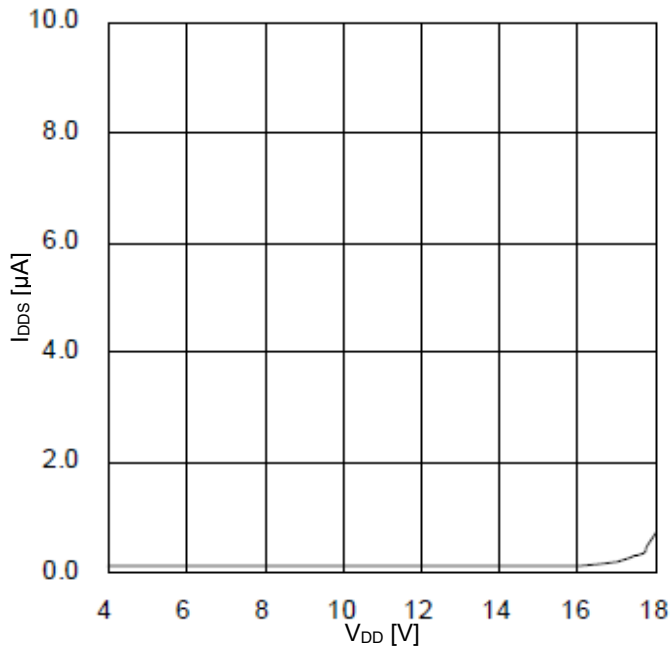


Figure 7.  
Standby Current  
(Measured Waveform)

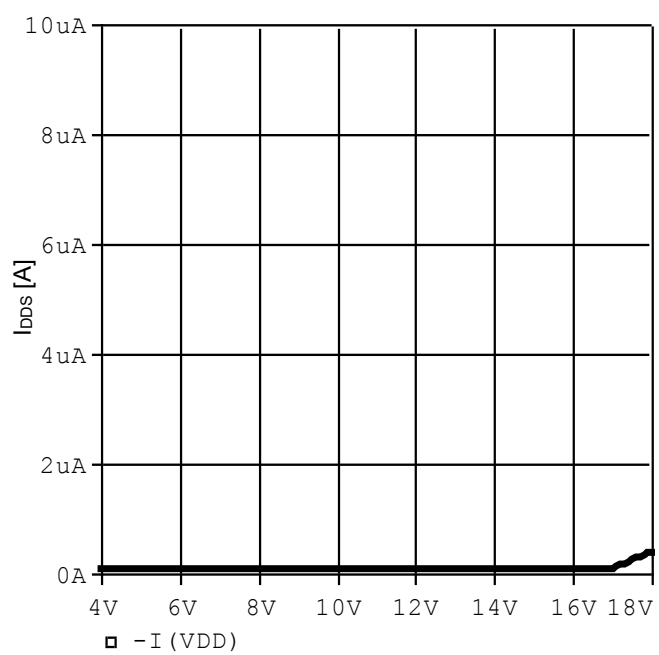


Figure 8.  
Standby Current  
(SPICE Simulation)

Table 5. Comparison of Characteristics

(Unless otherwise specified,  $V_{DD}=12V$ ,  $V_{IN}=5V$ )

Parameter	Measured Result	SPICE Simulation Result	Unit	Error	Condition
Standby Current	0.1	0.10	$\mu A$	0.0%	$V_{DD}=12V$ , $V_{IN}=0V$ , $V_{OUT}=0V$

(Note 1) The above data is based on a specific sample and it is not meant to be a guaranteed value.

### 3. Input Current

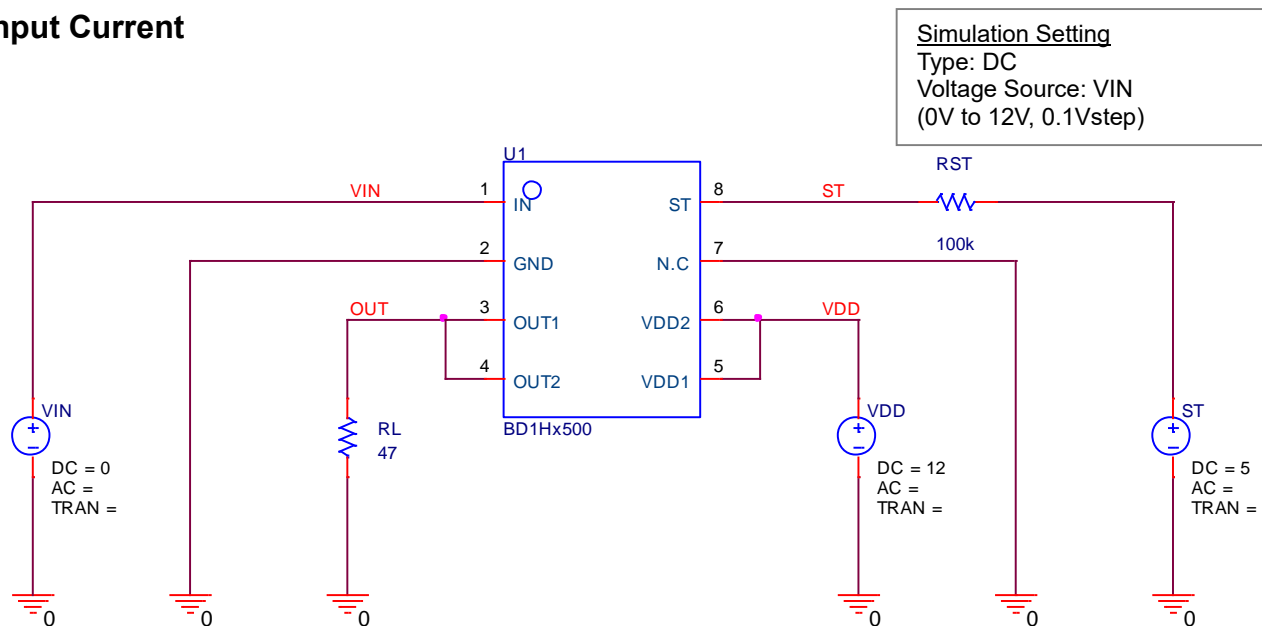


Figure 9.  
Simulation Schematic 3

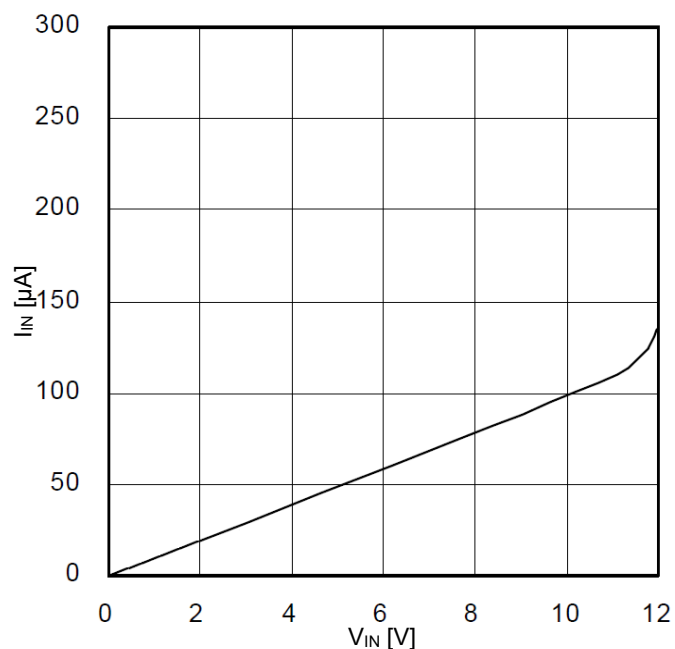


Figure 10.  
Input Current  
(Measured Waveform)

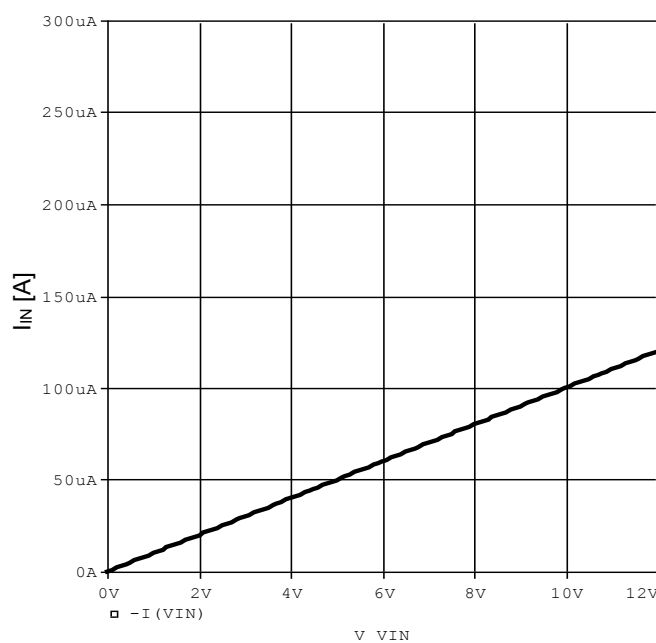


Figure 11.  
Input Current  
(SPICE Simulation)

Table 6. Comparison of Characteristics

(Unless otherwise specified,  $V_{DD}=12V$ ,  $V_{IN}=5V$ )

Parameter	Measured Result	SPICE Simulation Result	Unit	Error	Condition
Input Current	50	50.0	$\mu\text{A}$	0.0%	$V_{\text{IN}}=5\text{V}$

(Note 1) The above data is based on a specific sample and it is not meant to be a guaranteed value.

**Revision History**

Date	Revision	Changes
May.2018	001	New Release

## Notes

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