SPICE Modeling Report

1ch Low Side Switch IC
BV1LB028FPJ-C

In this report, the characteristics that can be confirmed by the simulation using the SPICE model of the 1ch Low Side Switch IC BV1LB028FPJ-C 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 : BV1LB028FPJ.lib
- Symbol File Name : BV1LB028FPJ.olb
- Subcircuit and Symbol

Table 1. Correspondence Table

Product Name	Subcircuit	Symbol
BV1LB028FPJ-C	BV1LB028FPJ (Rev:1.00)	BV1LB028FPJ

BV1LB028FPJ SPICE MODEL

- Terminal Information

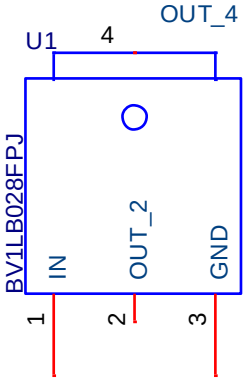

Figure 1. Symbol of BV1LB028FPJ

Table 2. Pin Table

Terminal No.	Terminal Name
1	IN
2	OUT_2*(NOTE1)*
3	GND
4	OUT_4*(NOTE1)*

Verifiable Characteristics

(Note 1) OUT_2 and OUT_4 are shorted inside the IC.
(Note 2) This model is not compatible with the influence of ambient temperature.
(Note 3) 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

Parameter	Modeled *(Note1)*	Value		Unit	Error	Condition
		Datasheet	SPICE			
Output Clamp Voltage	✓	48	48.1	V	0.2%	V_{IN}=0V, I_{OUT}=1mA
On-State Resistance (V_{IN}=5V)	✓	28	28.0	mΩ	0.0%	V_{IN}=5V, I_{OUT}=2.4A
On-State Resistance (V_{IN}=3V)	✓	35	34.9	mΩ	0.3%	V_{IN}=3V, I_{OUT}=2.4A
Leak Current	✓	0	0.0	μA	0.0%	V_{IN}=0V, V_{OUT}=18V
Turn-On Time	✓	-	63.2	μs	-	V_{IN}=0V to 5V, R_L=4.7Ω, V_{BAT}=12V
Turn-Off Time	✓	-	61.2	μs	-	V_{IN}=5V to 0V, R_L=4.7Ω, V_{BAT}=12V
Slew Rate On	✓	0.4	0.39	V/μs	2.5%	V_{IN}=0V to 5V, R_L=4.7Ω, V_{BAT}=12V
Slew Rate Off	✓	0.8	0.79	V/μs	1.3%	V_{IN}=5V to 0V, R_L=4.7Ω, V_{BAT}=12V
Input Threshold Voltage	✓	-	2.27	V	-	R_L=4.7Ω, V_{BAT}=12V
High-Level Input Current1 (in normal operation)	✓	100	100.0	μA	0.0%	V_{IN}=5V
Low-Level Input Current	✓	0	0.0	μA	0.0%	V_{IN}=0V
Overcurrent Detection Current	✓	40	39.5	A	1.3%	V_{IN}=5V

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

Timing Chart

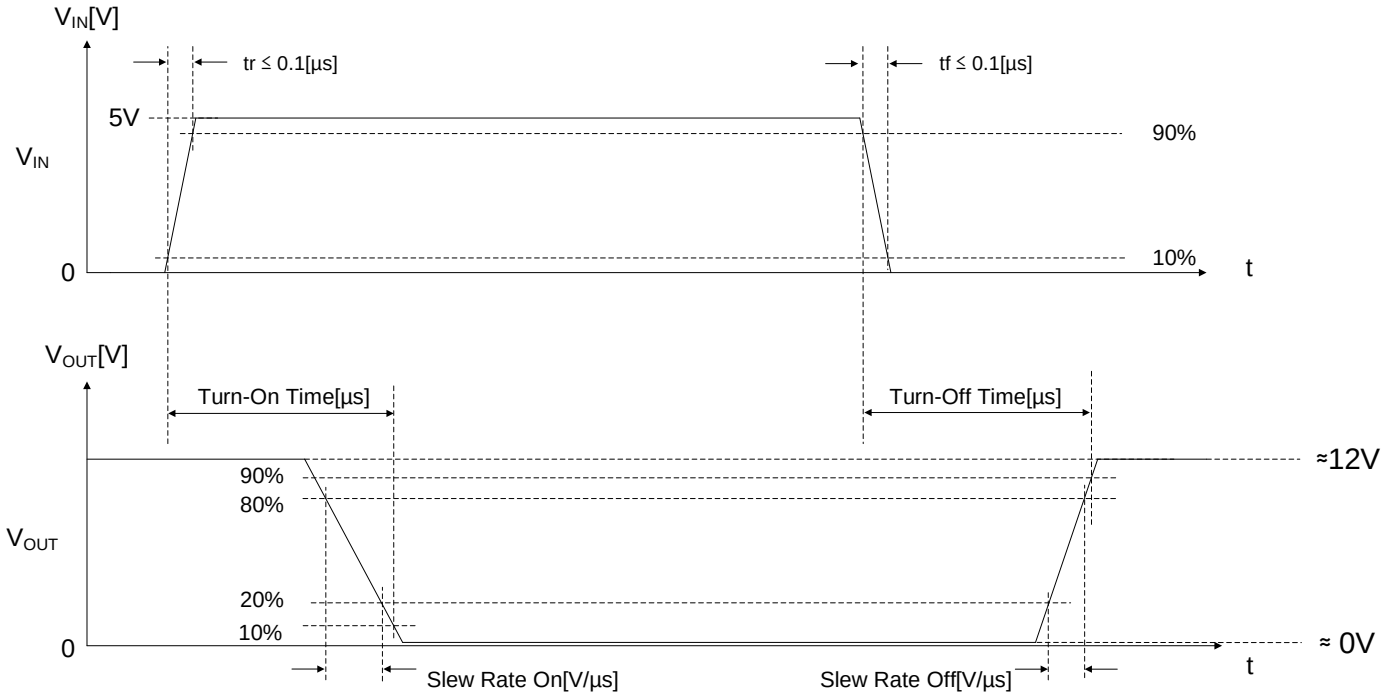

Figure 2. Switching Time

Characteristic Data (vs. Measured Waveform)

1. On-State Resistance

Simulation Setting
Type: DC
Voltage Source: VIN
(3.0V to 7.0V, 0.1Vstep)

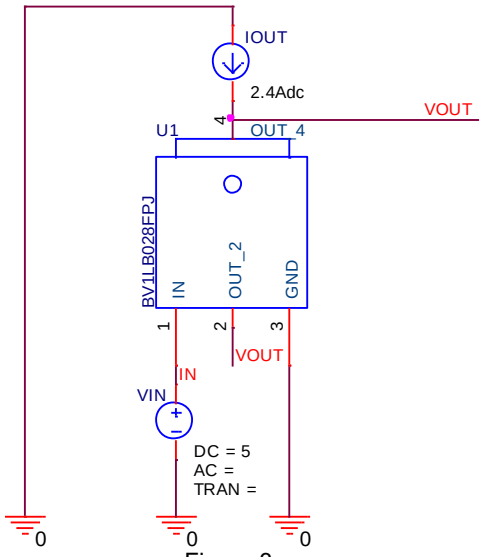

Figure 3.
Simulation Schematic 1.

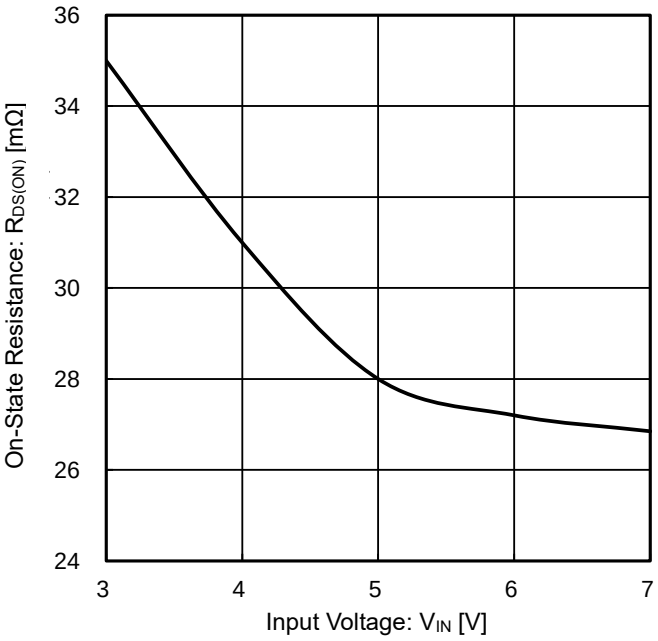

Figure 4.
On-State Resistance
(Measured Waveform)

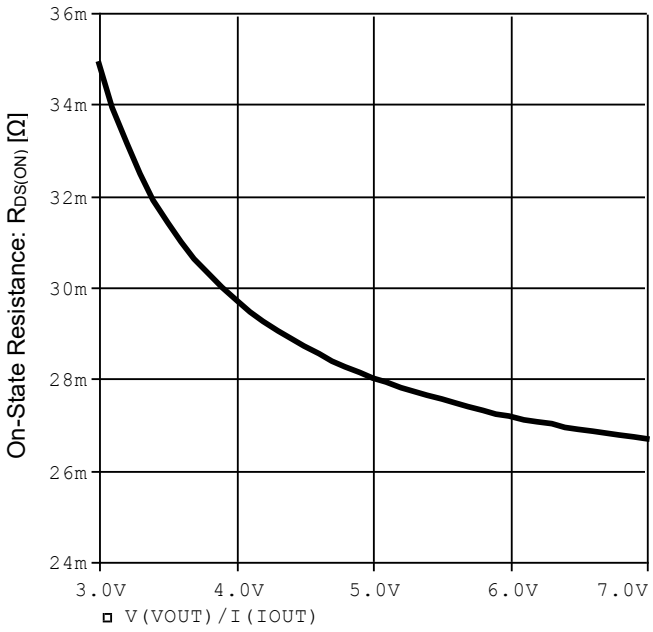

Figure 5.
On-State Resistance
(SPICE Simulation)

Table 4. Comparison of Characteristics

(Unless otherwise specified, V_{IN}=5.0V)

Parameter	Measured Result	SPICE Simulation Result	Unit	Error	Condition
On-State Resistance	28	28.0	mΩ	0.0%	V_{IN}=5V, I_{OUT}=2.4A
On-State Resistance	35	34.9	mΩ	0.3%	V_{IN}=3V, I_{OUT}=2.4A

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

2. Turn-On Time

Simulation Setting
Type: Transient
Run Time: 700µsec
(Maximum Step Size: 10nsec)

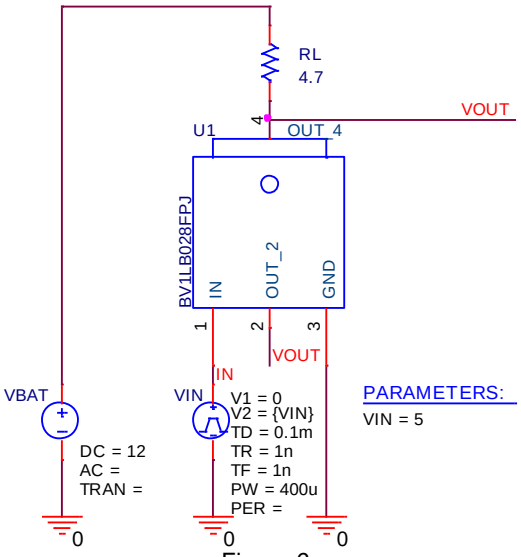

Figure 6.
Simulation Schematic 2

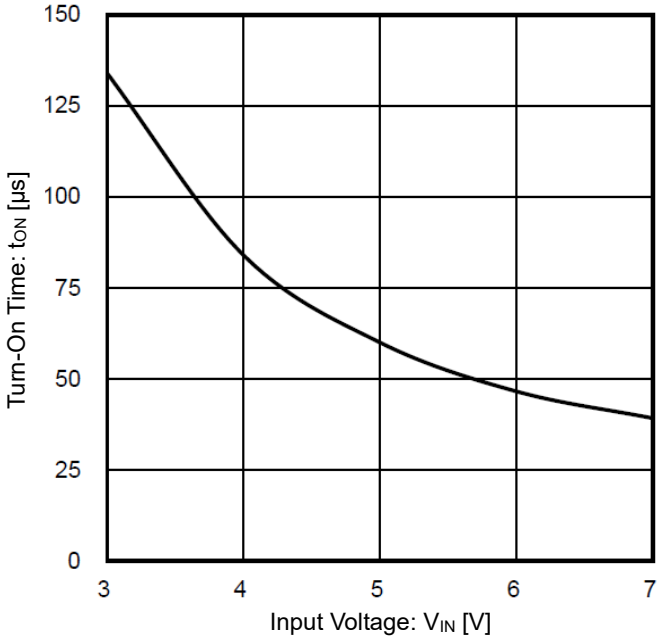

Figure 7.
Turn-On Time
(Measured Waveform)

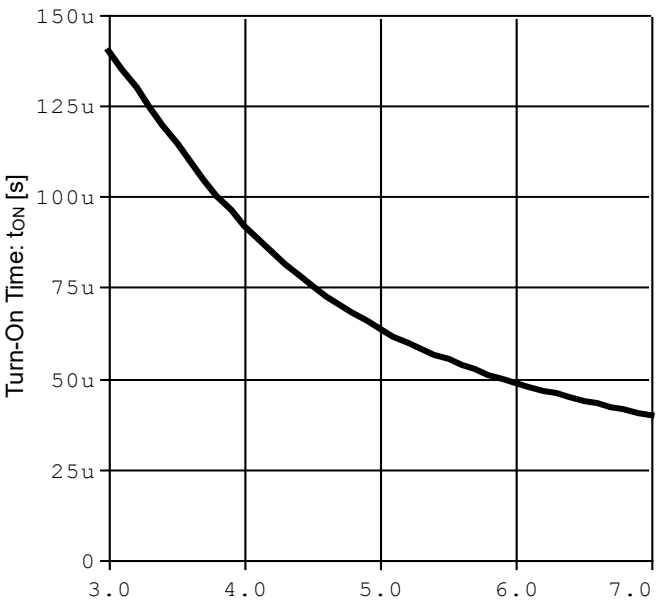

Figure 8.
Turn-On Time
(SPICE Simulation)

Table 5. Comparison of Characteristics

(Unless otherwise specified, V_{IN}=5.0V)

Parameter	Measured Result	SPICE Simulation Result	Unit	Error	Condition
Turn-On Time	61	63.2	µs	3.6%	V_{IN}=0V to 5V, R_L=4.7Ω, V_{BAT}=12V

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

3. Turn-Off Time

Simulation Setting
Type: Transient
Run Time: 700µsec
(Maximum Step Size: 10nsec)

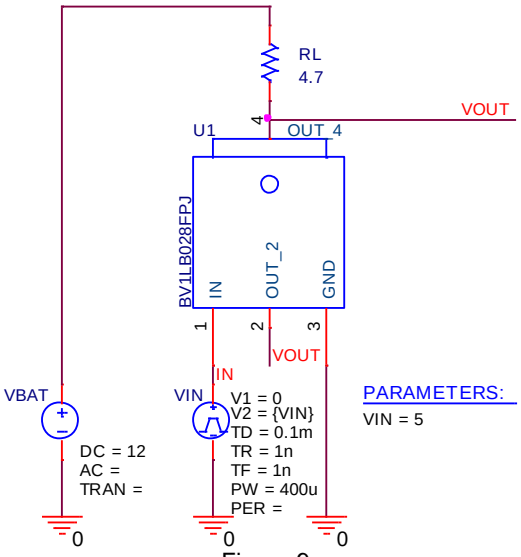

Figure 9.
Simulation Schematic 3

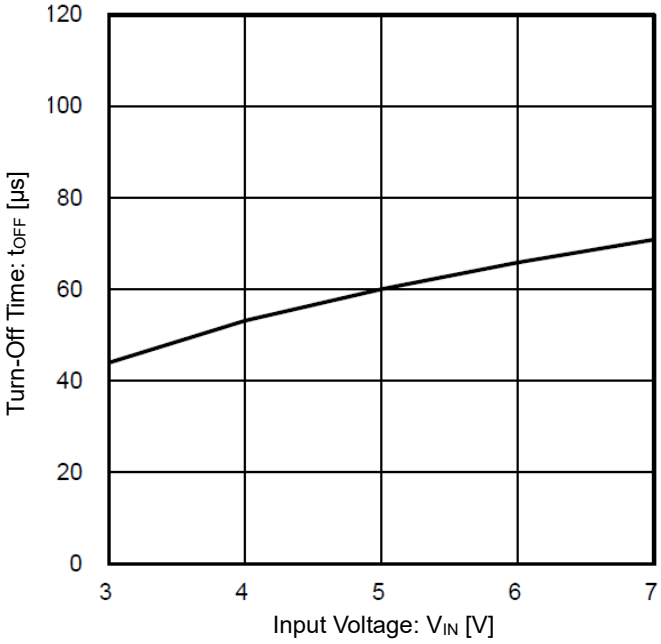

Figure 10.
Turn-Off Time
(Measured Waveform)

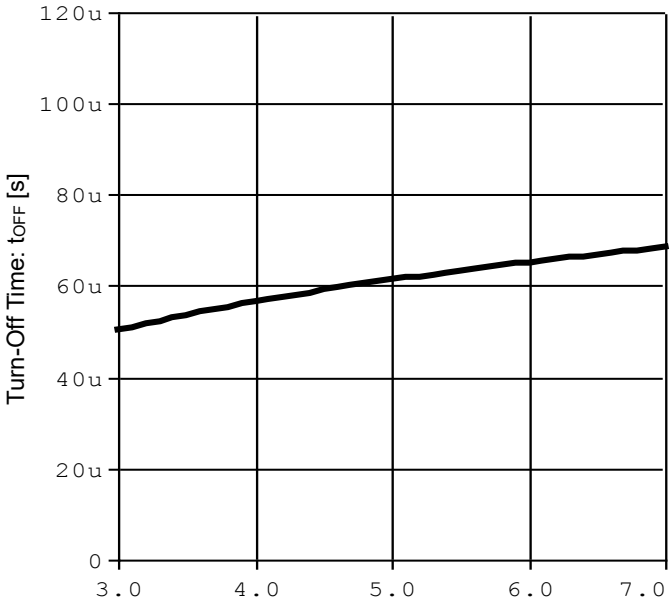

Figure 11.
Turn-Off Time
(SPICE Simulation)

Table 6. Comparison of Characteristics

(Unless otherwise specified, V_{IN}=5.0V)

Parameter	Measured Result	SPICE Simulation Result	Unit	Error	Condition
Turn-Off Time	60	61.2	µs	2.0%	V_{IN}=5V to 0V, R_L=4.7Ω, V_{BAT}=12V

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

4. Slew Rate On

Simulation Setting
Type: Transient
Run Time: 700µsec
(Maximum Step Size: 10nsec)

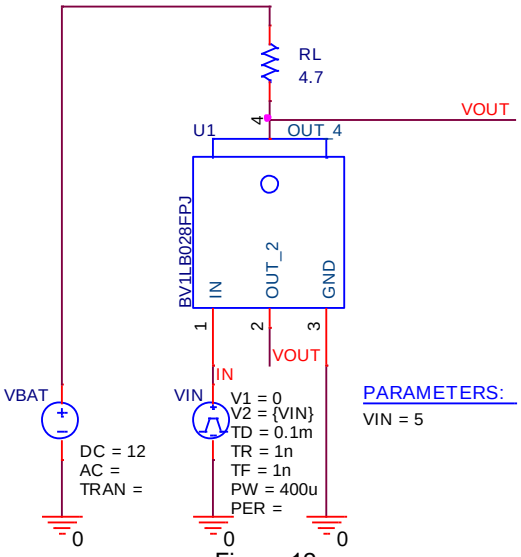

Figure 12.
Simulation Schematic 4

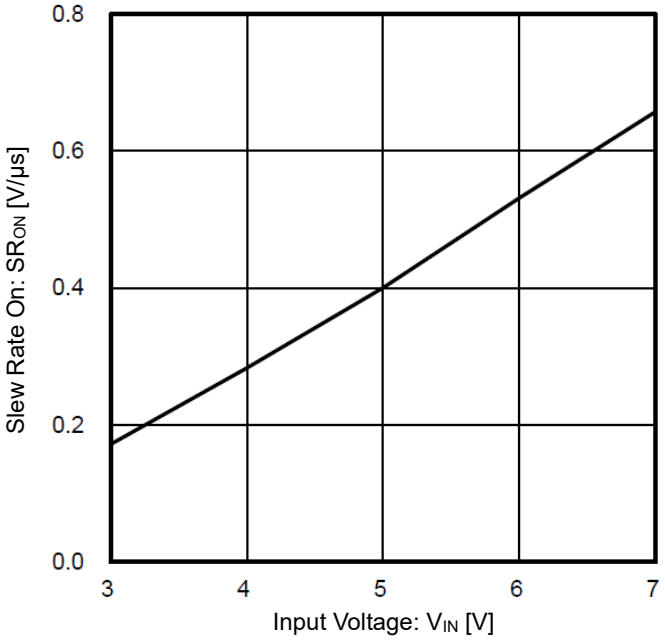

Figure 13.
Slew Rate On
(Measured Waveform)

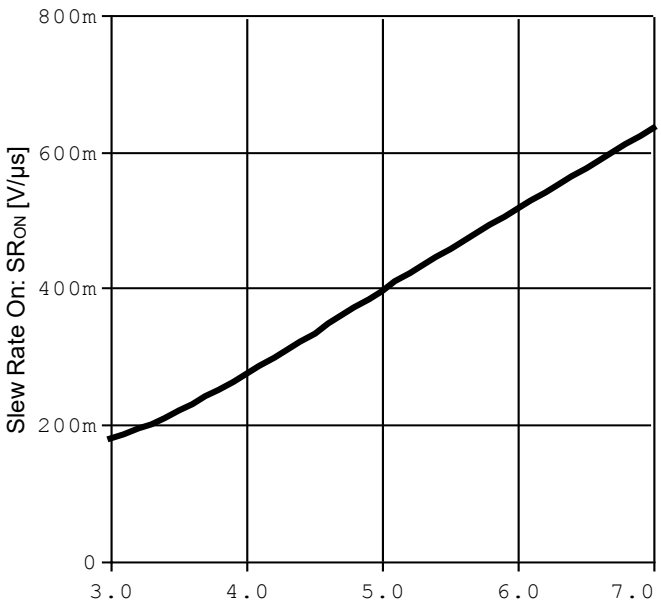

Figure 14.
Slew Rate On
(SPICE Simulation)

Table 7. Comparison of Characteristics

(Unless otherwise specified, V_{IN}=5.0V)

Parameter	Measured Result	SPICE Simulation Result	Unit	Error	Condition
Slew Rate On	0.4	0.39	V/µs	2.5%	V_{IN}=0V to 5V, R_L=4.7Ω, V_{BAT}=12V

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

5. Slew Rate Off

Simulation Setting
Type: Transient
Run Time: 700µsec
(Maximum Step Size: 10nsec)

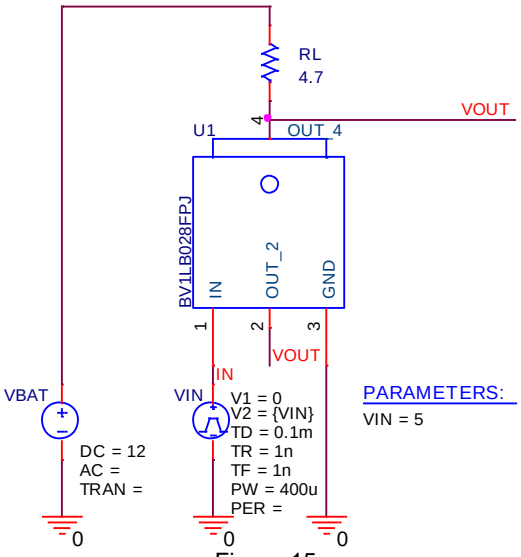

Figure 15.
Simulation Schematic 5

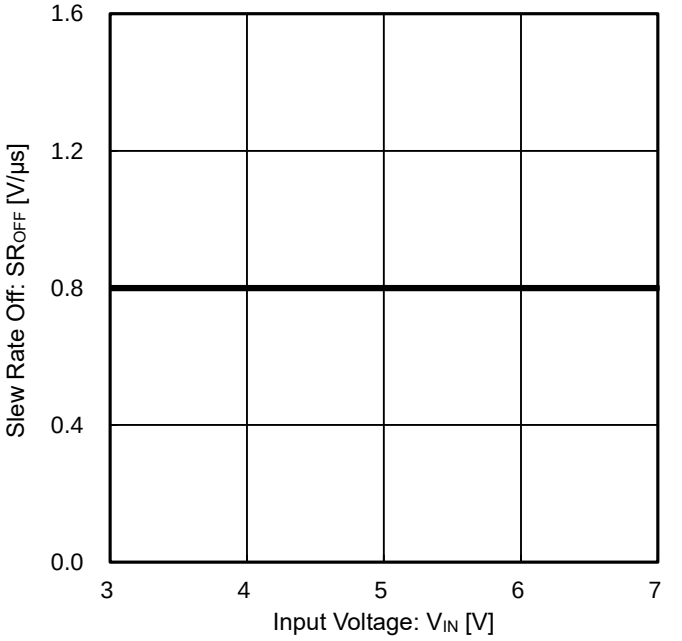

Figure 16.
Slew Rate Off
(Measured Waveform)

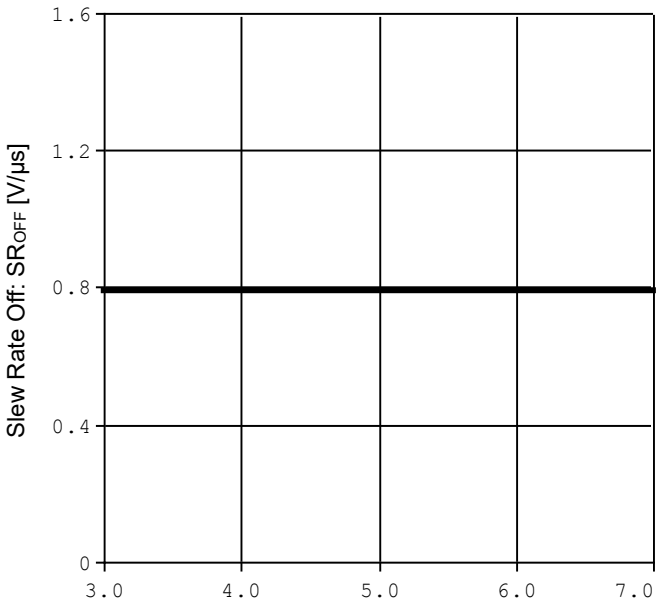

Figure 17.
Slew Rate Off
(SPICE Simulation)

Table 8. Comparison of Characteristics

(Unless otherwise specified, V_{IN}=5.0V)

Parameter	Measured Result	SPICE Simulation Result	Unit	Error	Condition
Slew Rate Off	0.8	0.79	V/µs	1.3%	V_{IN}=5V to 0V, R_L=4.7Ω, V_{BAT}=12V

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

6. High-Level Input Current1

Simulation Setting
Type: DC
Voltage Source: VIN
(3.0V to 7.0V, 0.1Vstep)

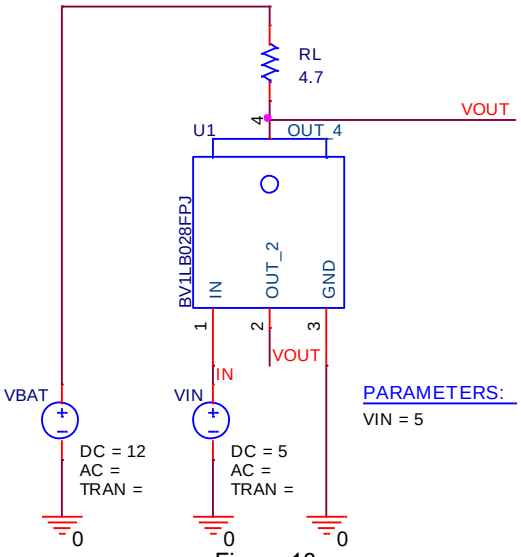

Figure 18.
Simulation Schematic 6

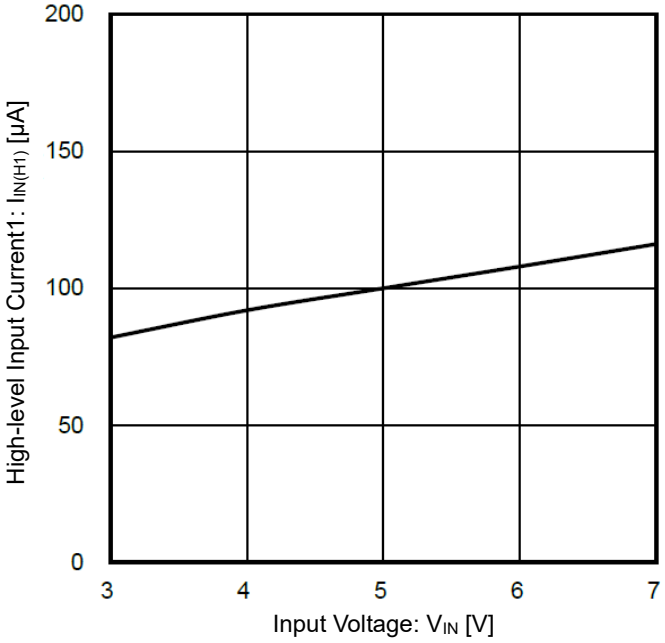

Figure 19.
High Level Input Current1
(Measured Waveform)

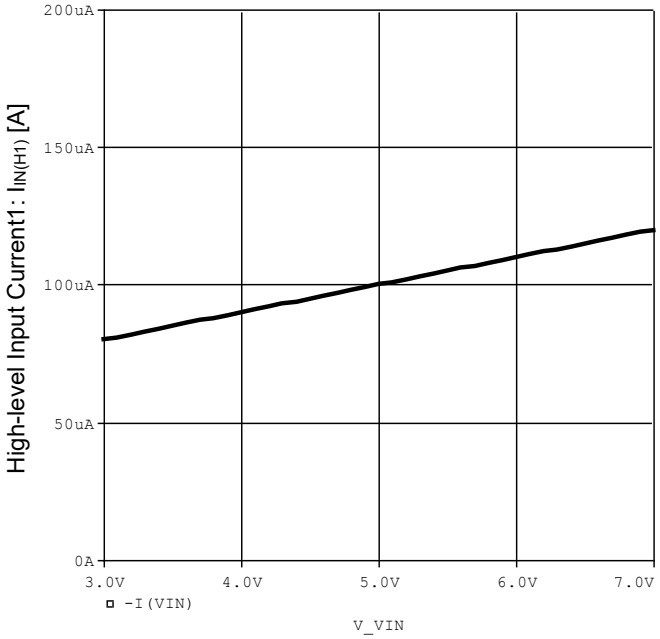

Figure 20.
High Level Input Current1
(SPICE Simulation)

Table 9. Comparison of Characteristics

(Unless otherwise specified, V_{IN}=5.0V)

Parameter	Measured Result	SPICE Simulation Result	Unit	Error	Condition
High Level Input Current1	100	100.0	μA	0.0%	V_{IN}=5V

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

7. Overcurrent Detection Current

Simulation Setting
Type: DC
Voltage Source: VOUT
(0.0V to 12.0V, 0.1Vstep)

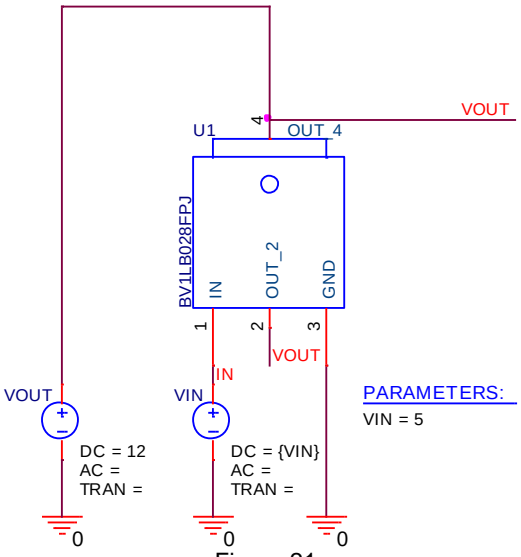

Figure 21.
Simulation Schematic 7

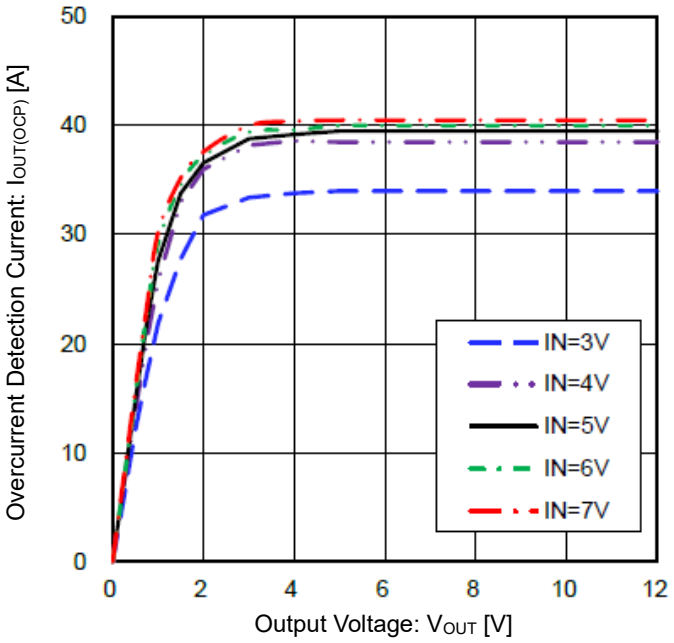

Figure 22.
Overcurrent Detection Current
(Measured Waveform)

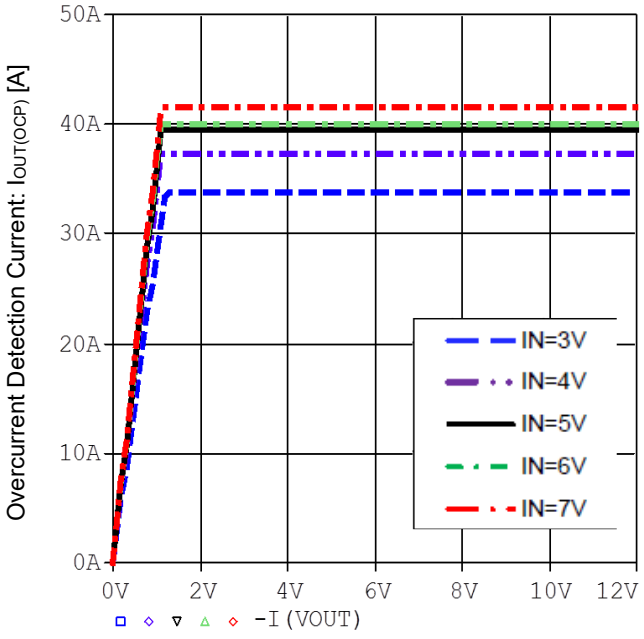

Figure 23.
Overcurrent Detection Current
(SPICE Simulation)

Table 10. Comparison of Characteristics

(Unless otherwise specified, V_{IN}=5.0V)

Parameter	Measured Result	SPICE Simulation Result	Unit	Error	Condition
Overcurrent Detection Current	40	39.5	A	1.3%	V_{IN}=5V

(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

1) The information contained herein is subject to change without notice.

2) Before you use our Products, please contact our sales representative and verify the latest specifications :

3) Although ROHM is continuously working to improve product reliability and quality, semiconductors can break down and malfunction due to various factors.
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4) Examples of application circuits, circuit constants and any other information contained herein are provided only to illustrate the standard usage and operations of the Products. The peripheral conditions must be taken into account when designing circuits for mass production.

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