MoDeCH

Global Design Infrastructure Innovation

Gate Driver ICモデル 詳細説明書

型番：2EDL05I06PJ | Infineon Technologies AG

2021.02.08

http://www.modech.com/

1. モデル実装機能・特性

1.1 実装機能

1.2 実現特性

1.3 端子定義

・実際のデバイスの機能すべてをモデルに実装しているわけではありません。
　また、同種類のデバイスでも実装機能には違いがある場合」が」あります。
・特性はその時点でのメーカーのデータシートよりモデリングしています。
　メーカーの仕様変更には対応していません。
・シミュレーションのシンボルは付属していません。

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1.1 実装機能（一部機能はモデルには未実装）

Functions	Device	Model
Gate Driver function	○	○
Undervoltage Lockout（UVLO）	○	○
Deadtime and Interlock Function	○	○
Bootstrap diode	○	○
Tolerant to negative transient voltage	○	—

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1.2.1 Target Fitting Characteristics

Parameter		Symbol	Values			Unit	Test condition
			Min.	Typ.	Max.		
High level input voltage		VIH	1.7	2.1	2.4	V	
Low level input voltage		VIL	0.7	0.9	1.1		
High level output voltage LO		VOH	–	VDD −0.45	VDD −1		IO = − 20 mA
HO			–	VB −0.45	VB −1		
Low level output voltage LO		VOL	–	VGND+0.13	VGND+0.3		IO = 20 mA
HO			–	VS+0.13	VS +0.3		
VDD supply undervoltage positive going threshold	IGBT−types	VDDUV+	11.8	12.5	13.2		
	MOSFET types		8.3	9.1	9.9		
VBS supply undervoltage positive going threshold	IGBT−types	VBSUV+	10.9	11.6	12.4		
	MOSFET types		8.3	9.1	9.9		
VDD supply undervoltage negative going threshold	IGBT−types	VDDUV−	10.9	11.6	12.4		
	MOSFET types		7.5	8.3	9		
VBS supply undervoltage negative going threshold	IGBT−types	VBSUV−	10	10.7	11.7		
	MOSFET types		7.5	8.3	9		
VDD and VBS supply UVLO hysteresis	IGBT−types	VDDUVH VBSUVH	0.5	0.9	–		
	MOSFET types		0.5	0.9	–		

全て、Typ値、Ta=25℃の値で合わせこみ

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1.2.2 Target Fitting Characteristics

Parameter	Symbol	Values			Unit	Test condition
		Min.	Typ.	Max.		
Input bias current	ILIN+	15	35	60	μA	VLIN = 3.3 V
Input bias current	ILIN−	−	0	−		VLIN = 0
Input bias current	IHIN+	15	35	60		VHIN = 3.3 V
Input bias current	IHIN−	−	0	−		VHIN = 0
Bootstrap diode forward voltage between VDD and VB	VF,BSD	−	1	1.2	V	IF = 0.3 mA
Bootstrap diode forward current between VDD and VB	IF,BSD	30	55	80	mA	VDD − VB = 4 V

全て、Typ値、Ta=25℃の値で合わせこみ

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1.2.3 Target Fitting Characteristics

Parameter		Symbol	Values			Unit	Test condition
			Min.	Typ.	Max.		
Turn-on propagation delay	IGBT types	ton	280	420	610	ns	VLIN/HIN = 0 or 3.3 V
	MOSFET types		210	310	460		
Turn-off propagation delay	IGBT types	toff	260	400	590		
	MOSFET types		200	300	440		
Turn-on rise time		tr	–	48	80		VLIN/HIN = 0 or 3.3 V CL = 1 nF
Turn-off fall time		tf	–	24	40		
Input filter time at LIN/HIN for turn on and off	IGBT types	tFILIN	120	192	–		VLIN/HIN = 0 & 3.3 V
	MOSFET types						
	HIN		50	100	170		
	LIN		100	150	250		
Dead time (not for 2EDL05I06BF)	IGBT types	DT	260	380	540	ns	VLIN/HIN = 0 & 3.3 V
	MOSFET types	MDT	30	75	140		

全て、Typ値、Ta=25℃の値で合わせこみ

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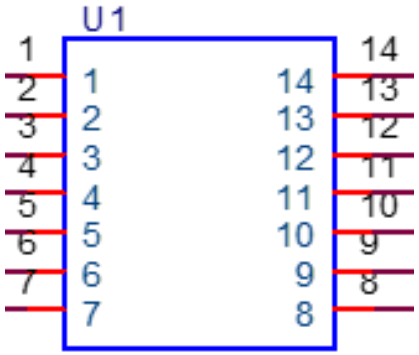
1.3 端子定義

Pin no.	Name	Function
1	VDD	Low-side and logic supply voltage
2	HIN	Logic input for high-side gate driver output (HO), in phase. Schmitt trigger inputs with hysteresis and pull down
3	LIN	Logic input for low-side gate driver output (LO), in phase. Schmitt trigger inputs with hysteresis and pull down
4	GND	Low-side gate drive return
5	LO	Low-side driver output
6	VS	High voltage floating supply return
7	HO	High-side driver output
8	VB	High-side gate drive floating supply



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2.モデル検証条件

- 対応シミュレータ
  - PSpice V17.2
- Ta=25℃、TNOM=25℃

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3.検証結果

3.1 HIN threshold
3.2 LIN threshold
3.3 HO VOLH
3.4 LO VOLH
3.5 VBS UVLO
3.6 VDD UVLO
3.7 Input bias current
3.8 Bootstrap diode VF
3.9 Bootstrap diode IF
3.10 Turn-on/off propagation delay
3.11 Turn-on rise time & Turn-off fall time
3.12 Input filter time at LIN/HIN for turn on and off
3.13 Dead time
3.14 Function (Normal operation)

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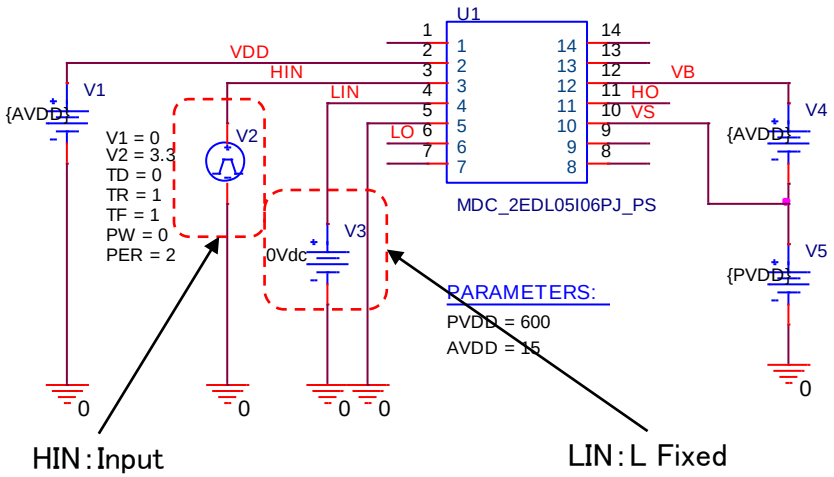
3.1.1 HIN threshold



HIN端子のしきい値を計測します。

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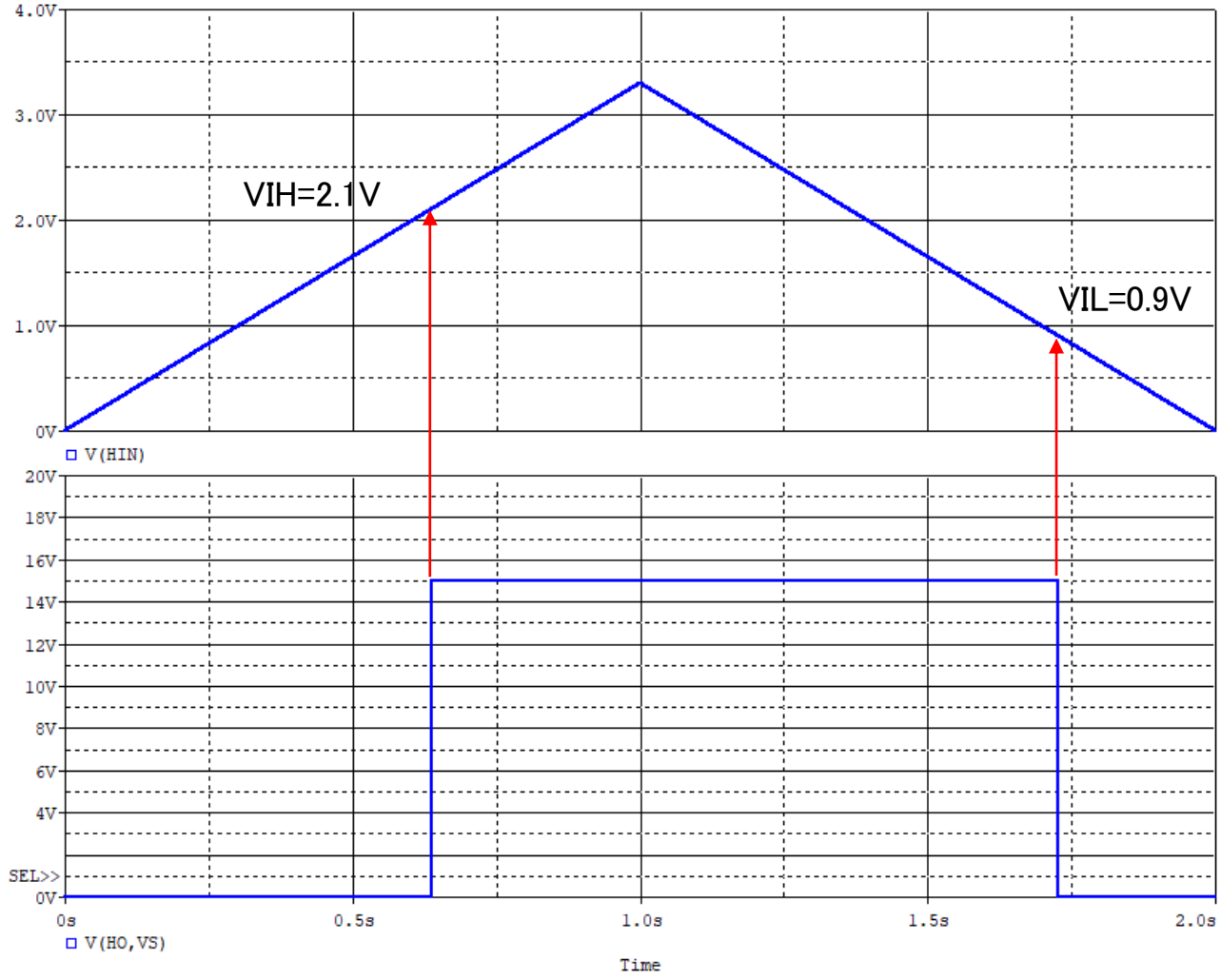
3.1.2 HIN threshold

HIN

HO-VS



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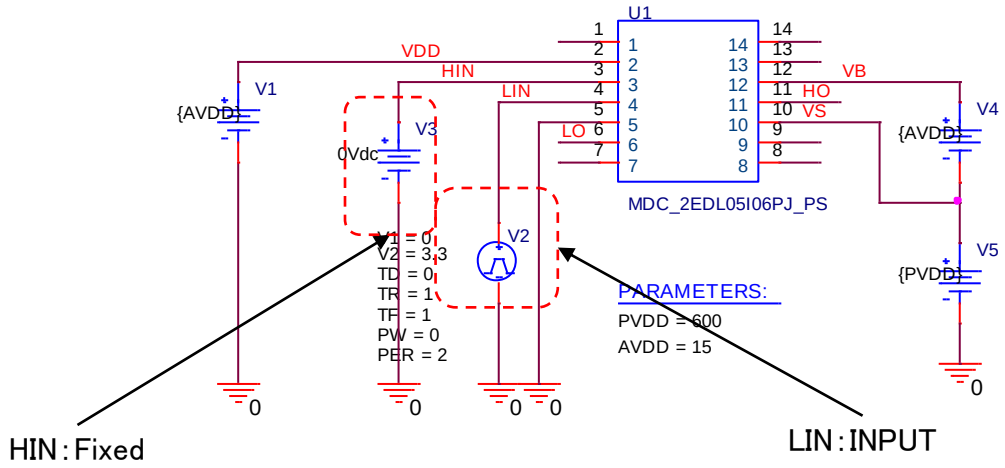
3.2.1 LIN threshold



LIN端子のしきい値を計測します。

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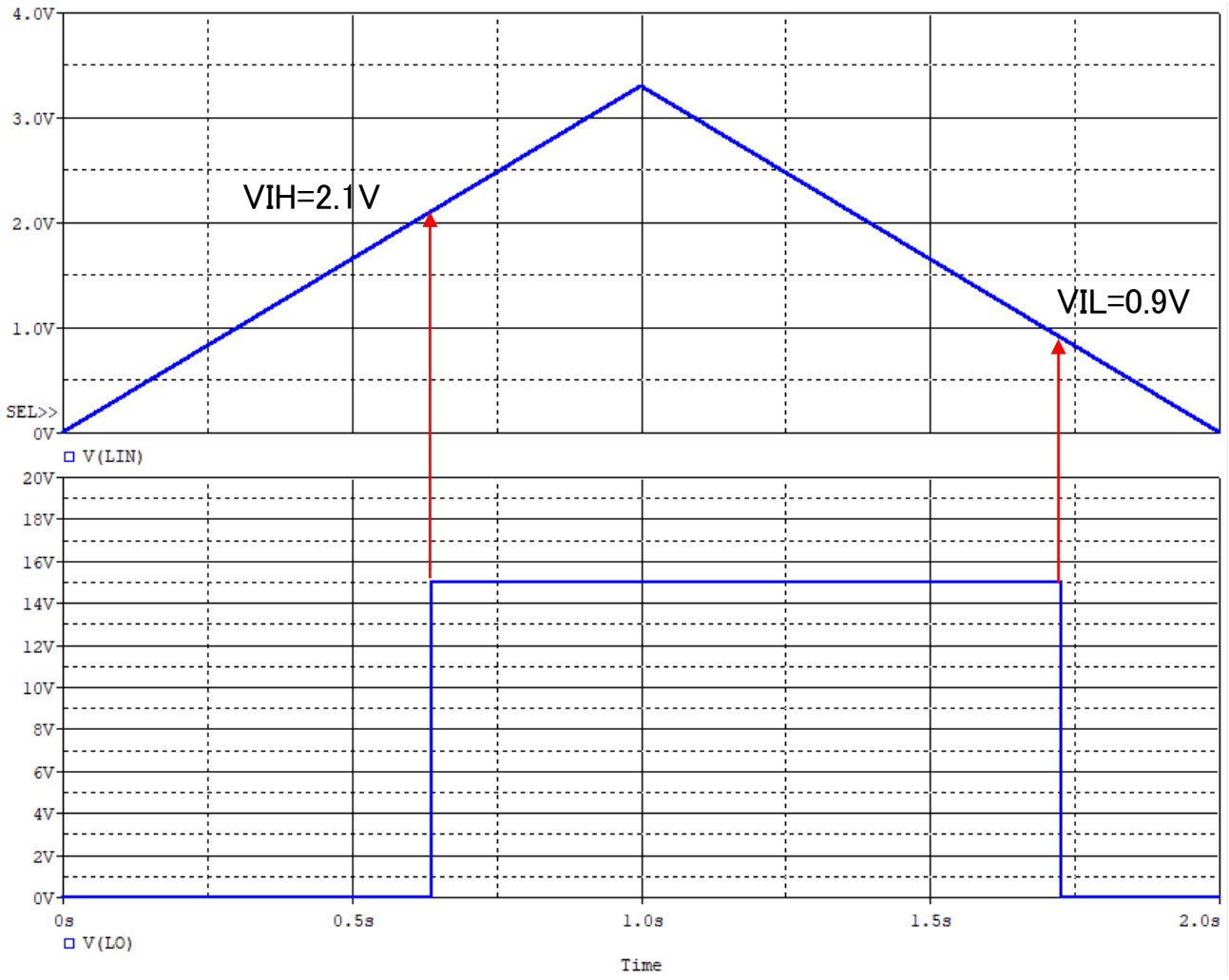
3.2.2 LIN threshold

LIN

LO



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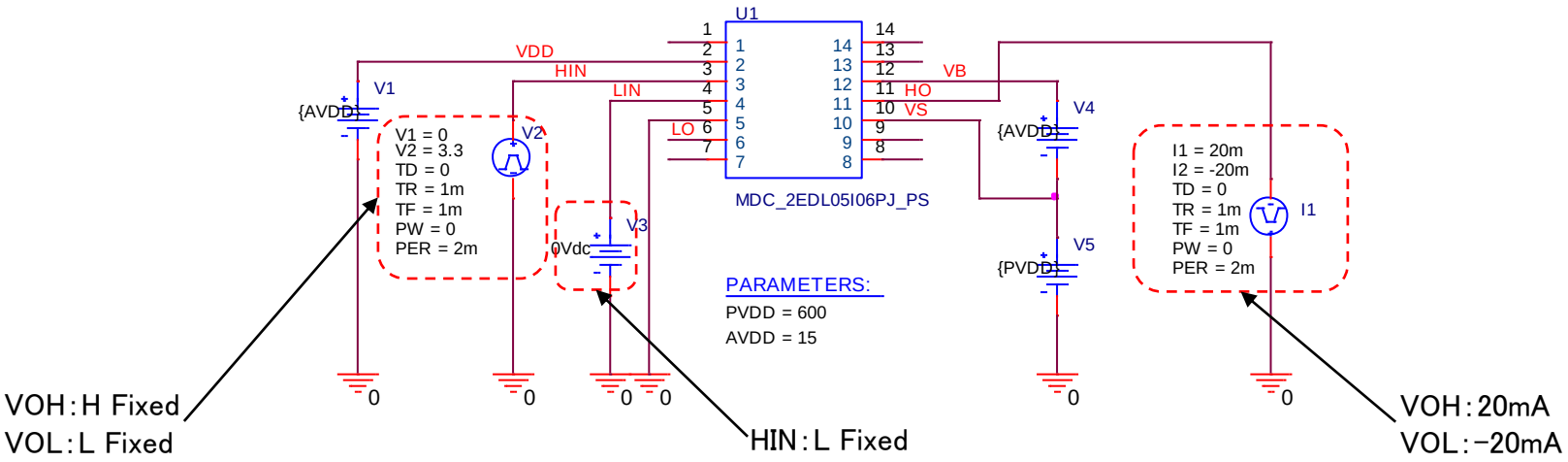
3.3.1 HO VOLH



HO端子の出力電圧を計測します。

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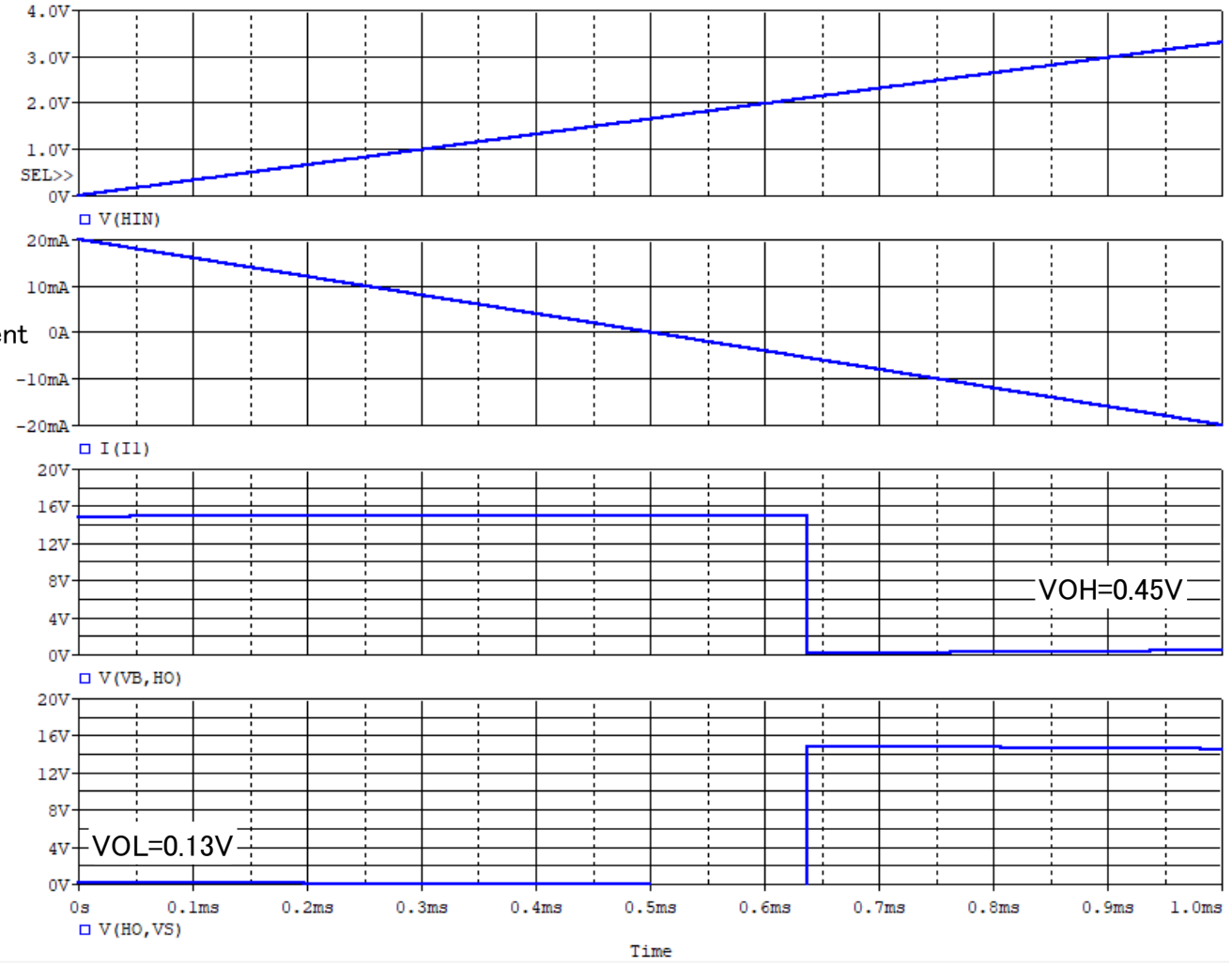
3.3.2 HO VOLH

HIN

Output Current

VB-HO

HO-VS



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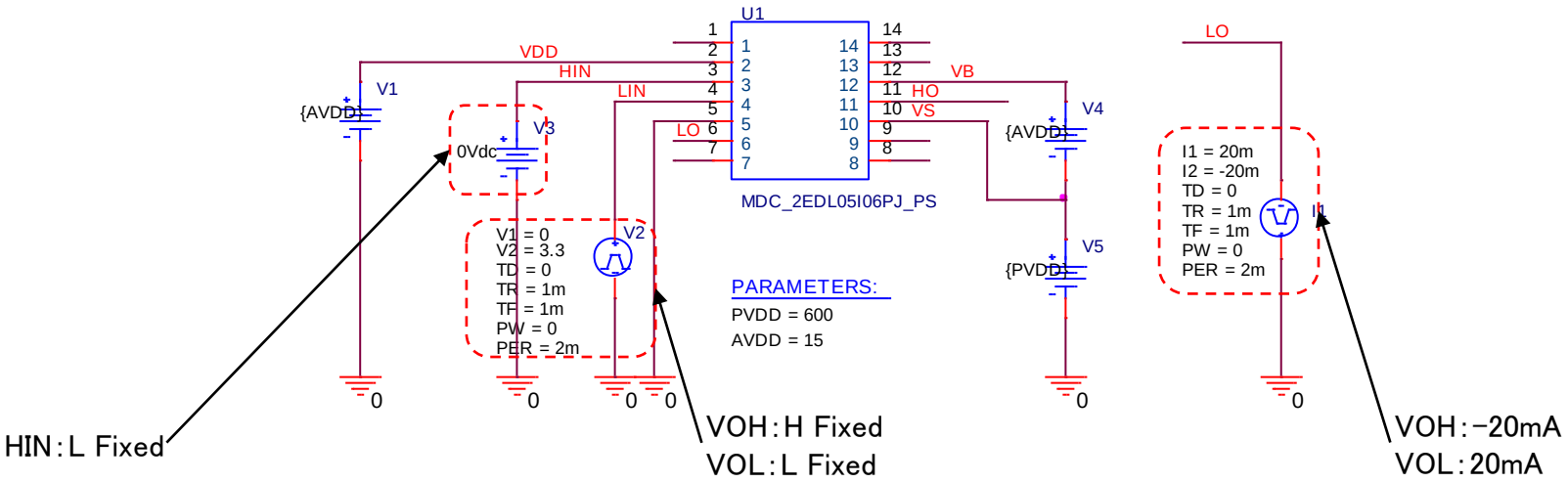
3.4.1 LO VOLH



LO端子の出力電圧を計測します。

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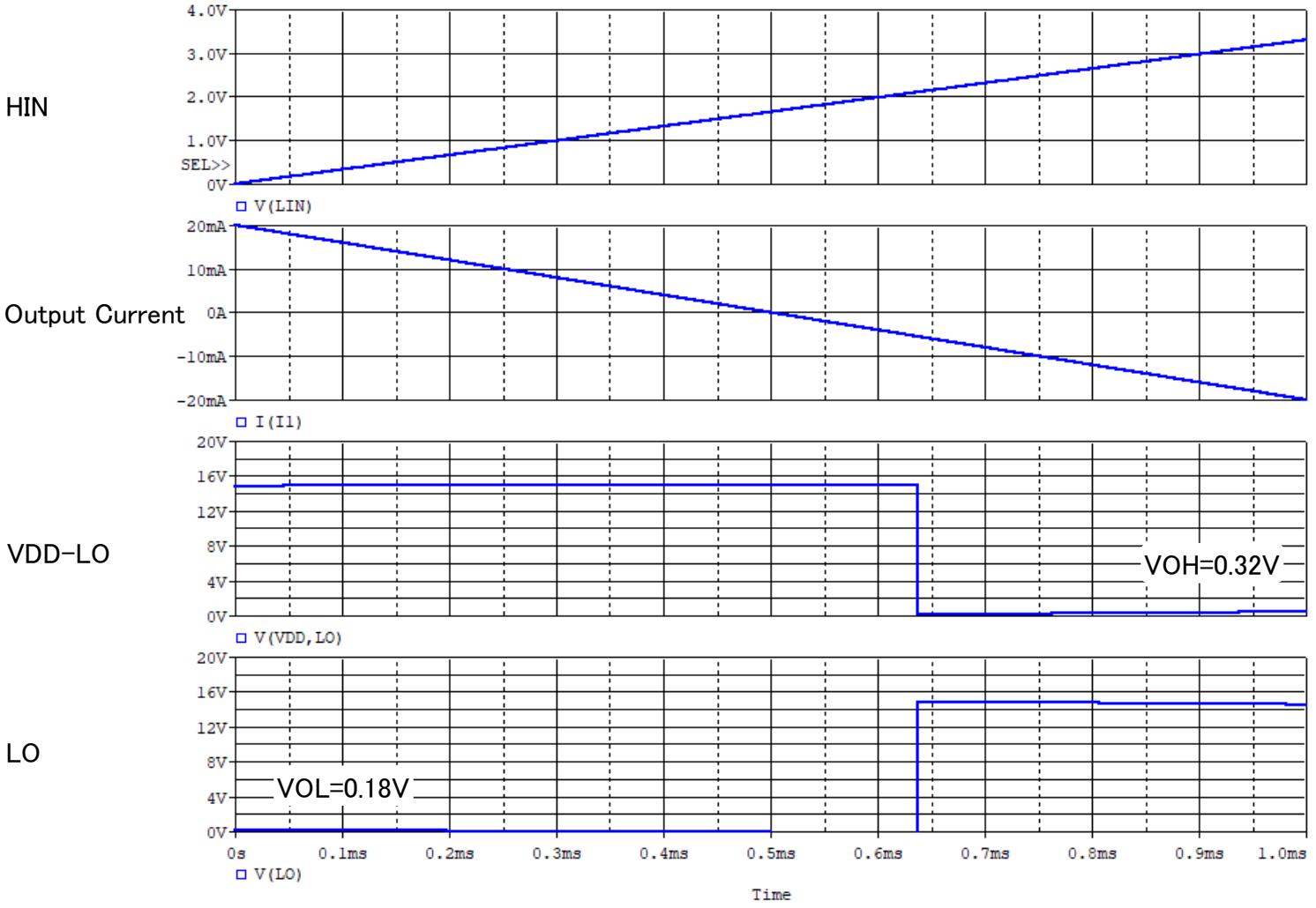
3.4.2 LO VOLH



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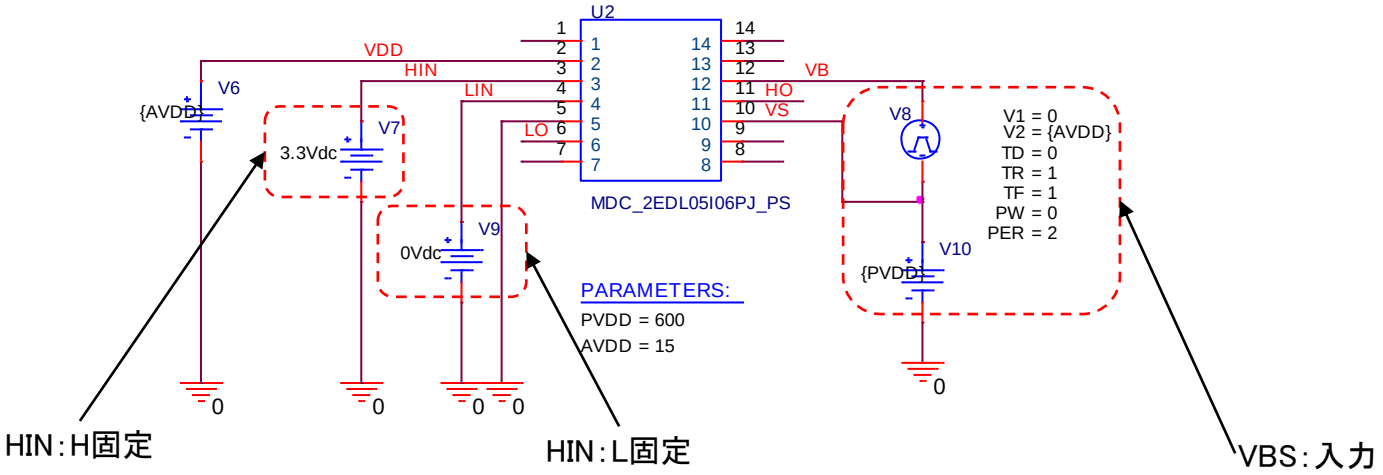
3.5.1 VBS UVLO threshold



VB電源のUVLO(Under Voltage Lock Out)を計測します。

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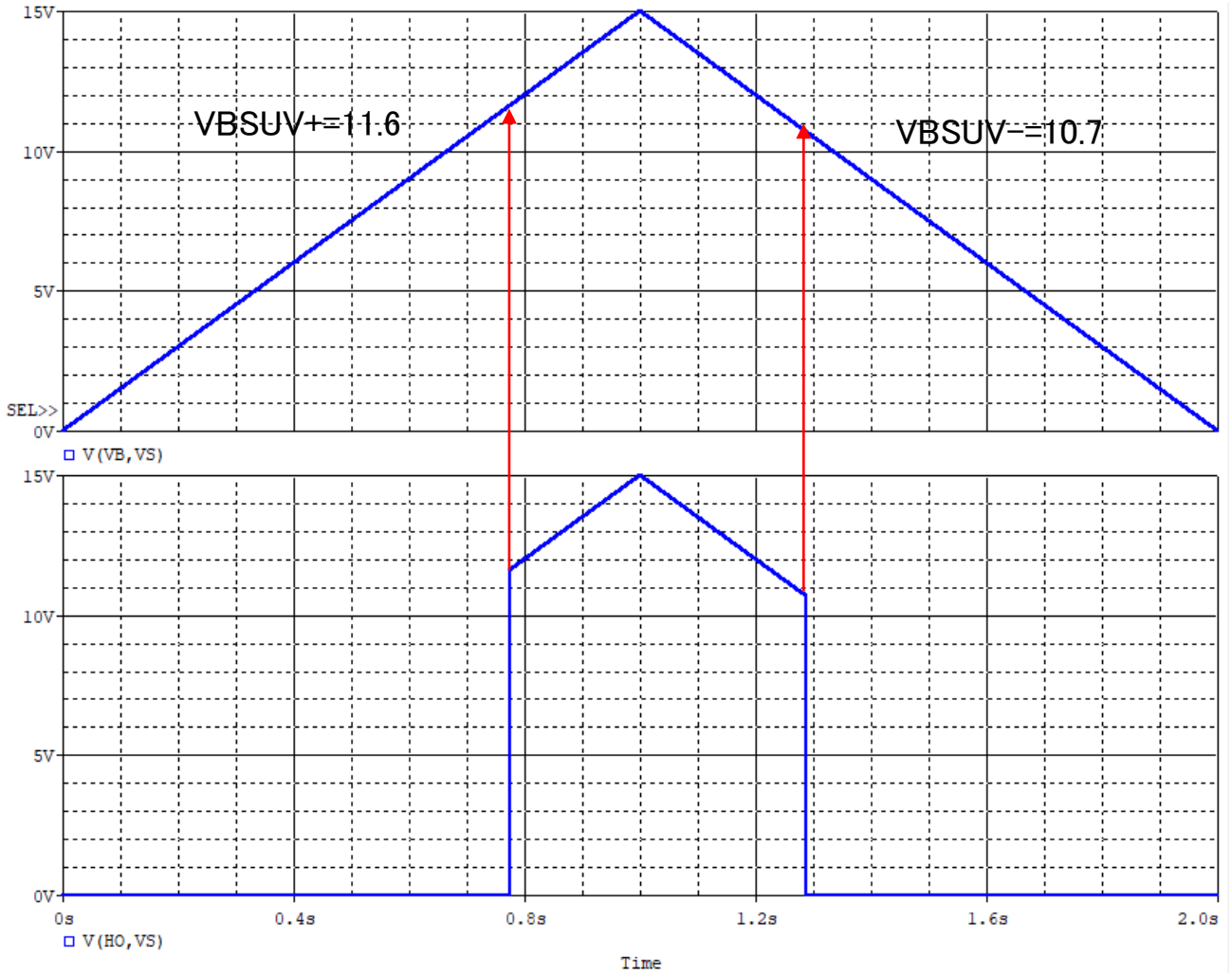
3.5.2 VBS UVLO threshold

VB−VS

HO−VS



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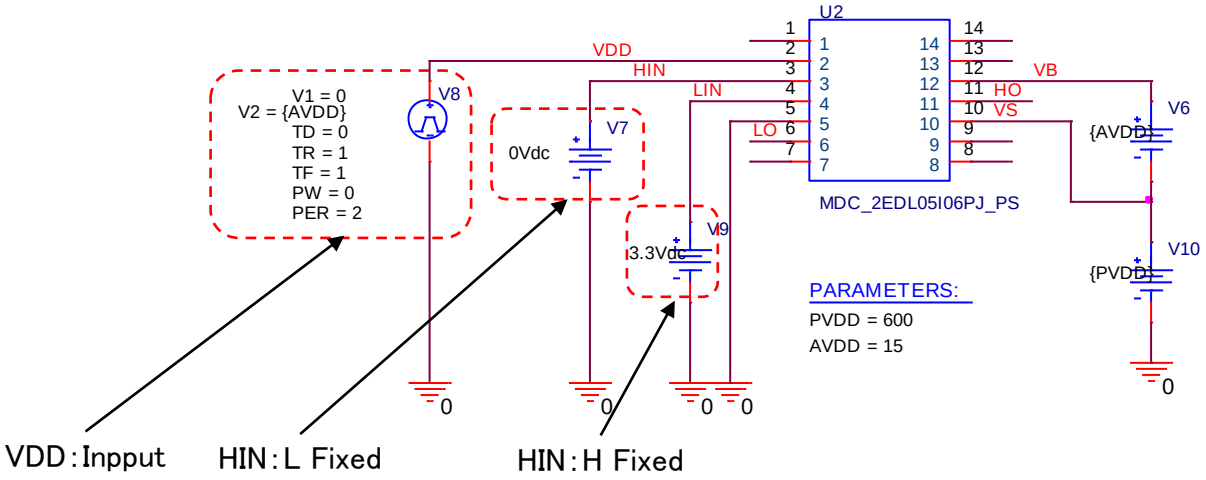
3.6.1 VDD UVLO threshold



VDD電源のUVLO(Under Voltage Lock Out)を計測します。

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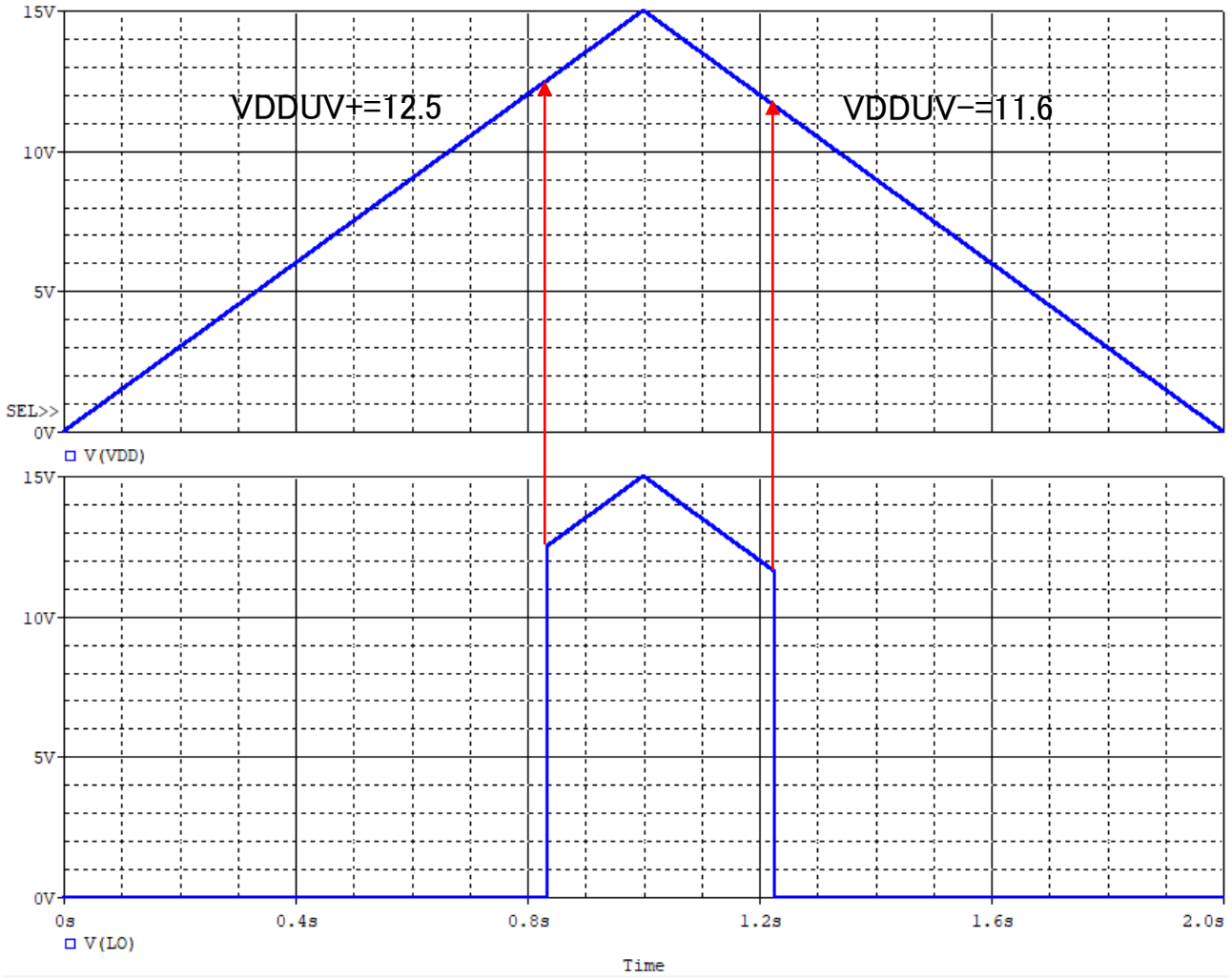
3.6.2 VDD UVLO threshold

VDD

LO



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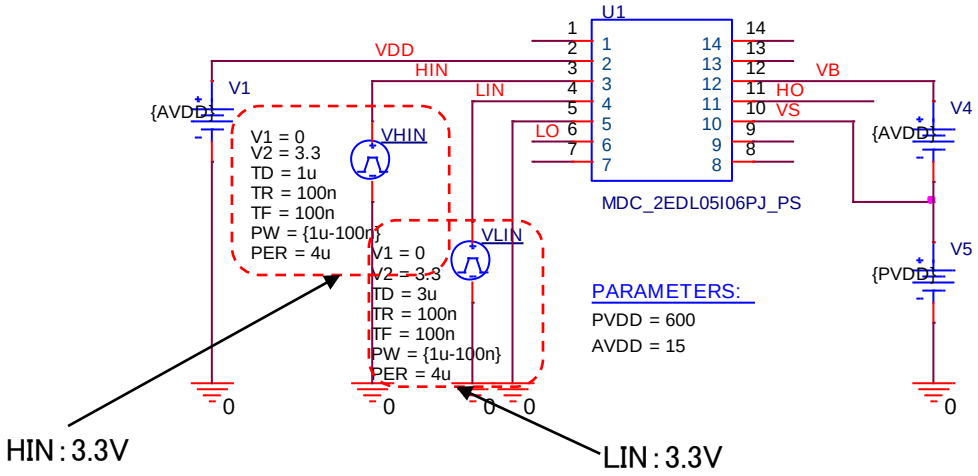
3.7.1 Input bias current



入力バイアス電流を計測します。

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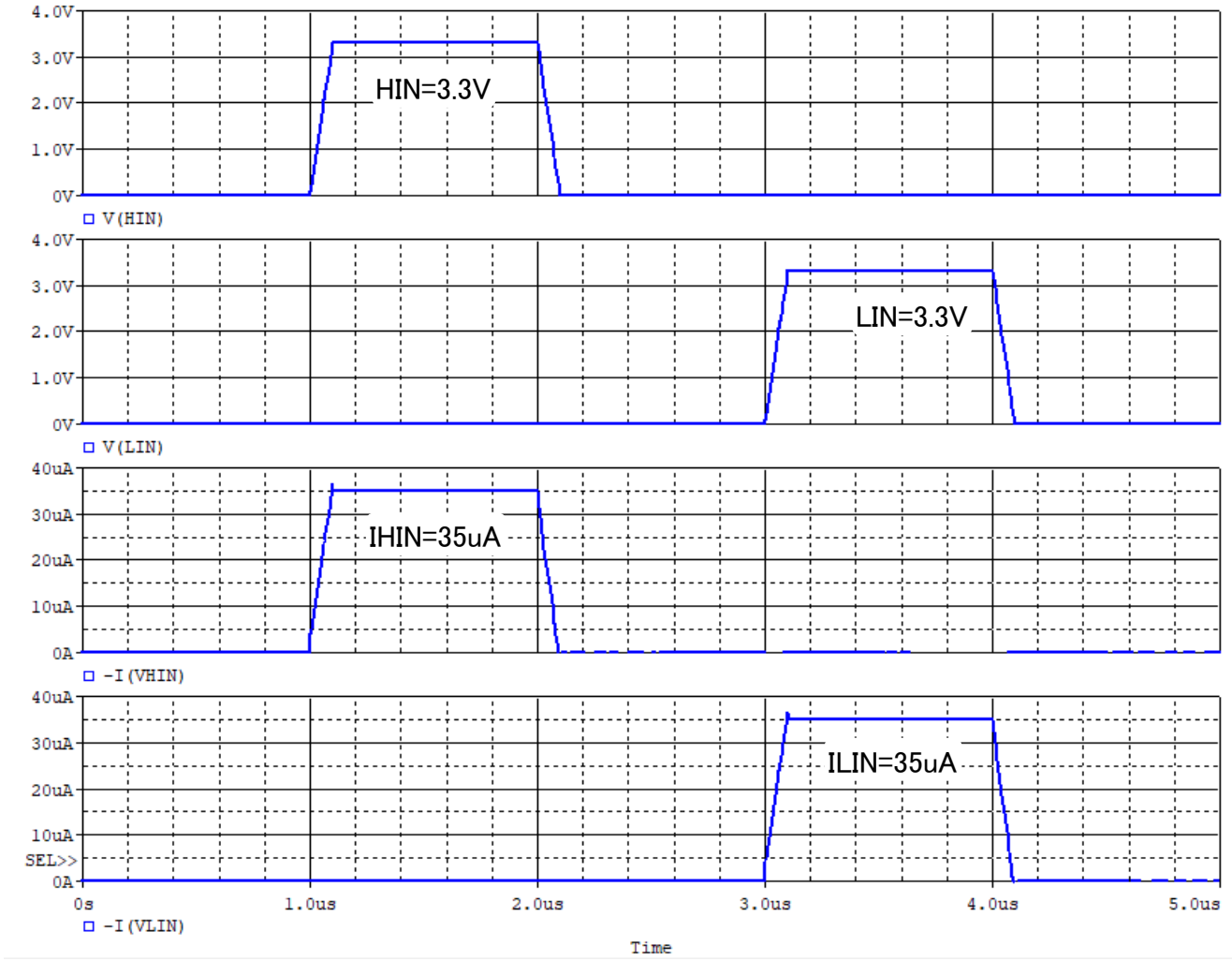
3.7.2 Input bias current

HIN

LIN

IHIN

ILIN



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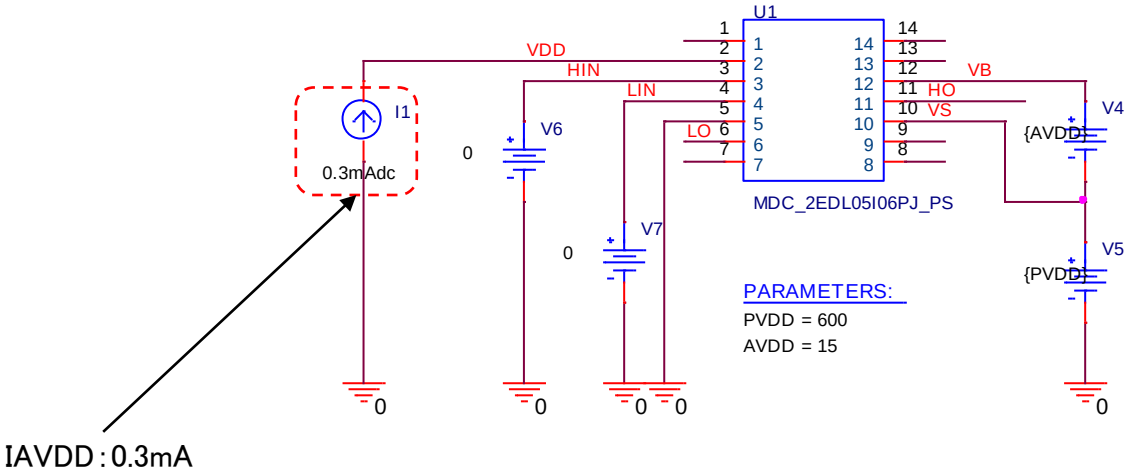
3.8.1 Bootstrap diode VF



IAVDD : 0.3mA

ブートストラップ回路内蔵ダイオードの
順方向立ち上がり電圧を計測します。

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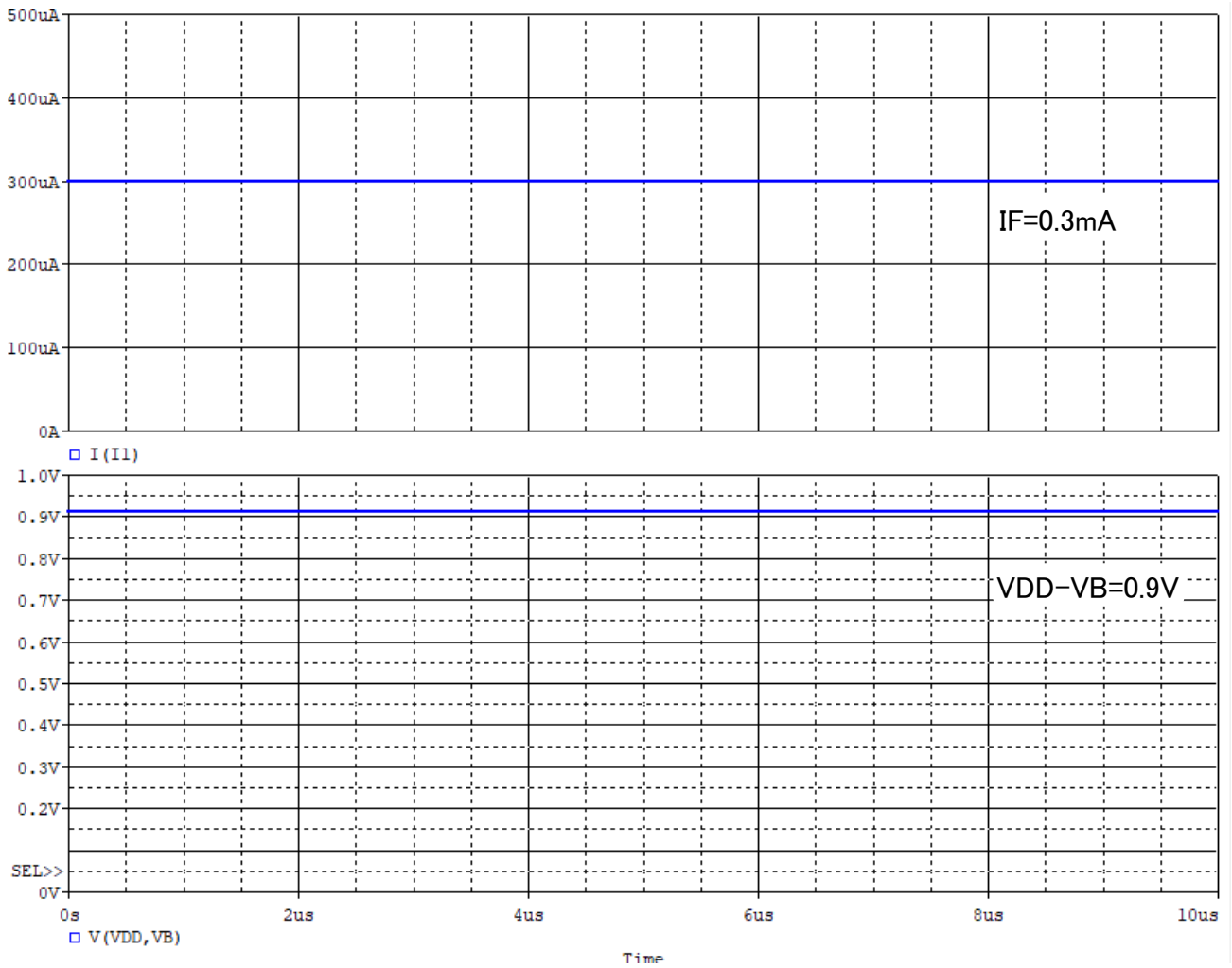
3.8.2 Bootstrap diode VF

IF=IVDD

VDD−VB



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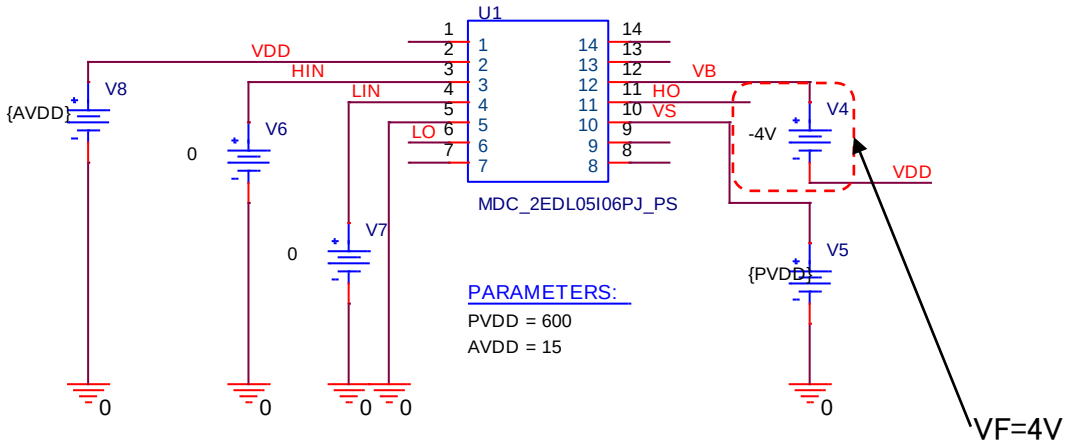
3.9.1 Bootstrap diode IF



ブートストラップ回路内蔵ダイオードの
順方向を計測します。

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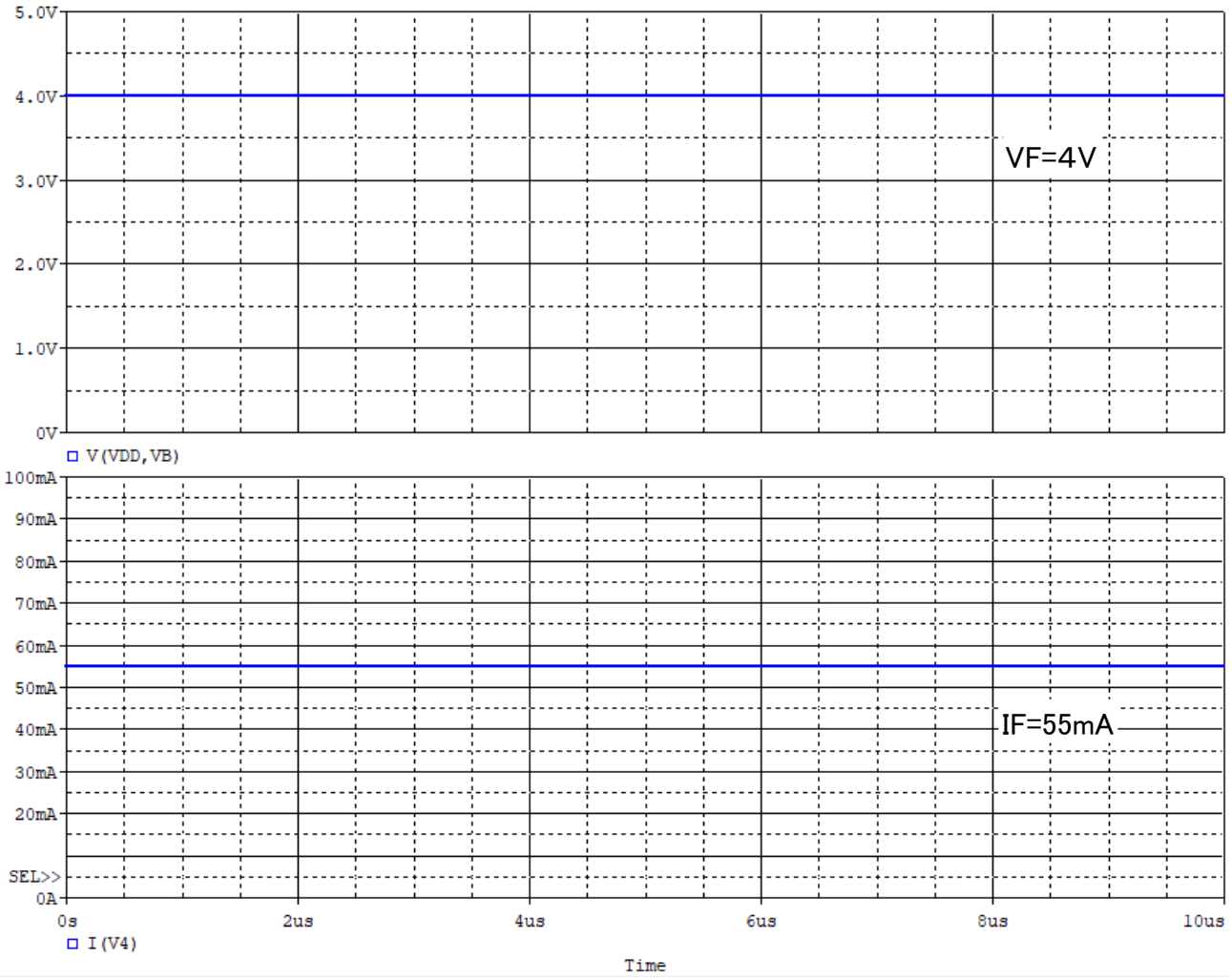
3.9.2 Bootstrap diode IF

VDD−VB=VF

IF



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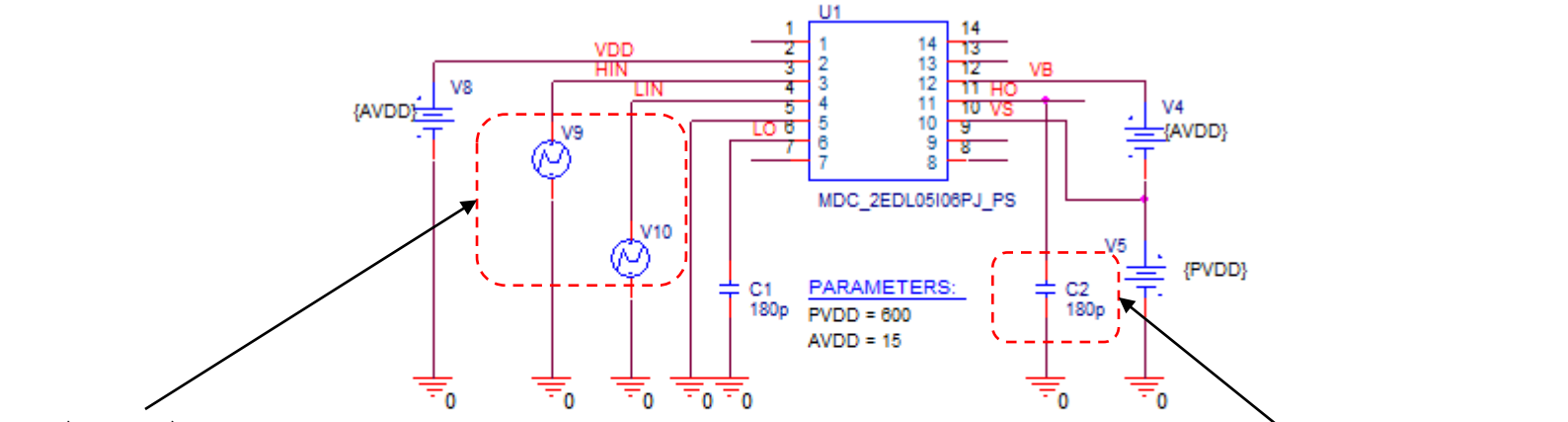
3.10.1 Turn-on/off propagation delay



T1 = 0	V1 = 0	T11 = +1n	V11 = 3.3
T2 = 2u	V2 = 0	T12 = 22u	V12 = 3.3
T3 = +1n	V3 = 3.3	T13 = +1n	V13 = 0
T4 = 8u	V4 = 3.3	T14 = 24u	V14 = 0
T5 = +1n	V5 = 0	T15 = +1n	V15 = 3.3
T6 = 12u	V6 = 0	T16 = 34u	V16 = 3.3
T7 = +1n	V7 = 3.3	T17 = +1n	V17 = 0
T8 = 14u	V8 = 3.3		
T9 = +1n	V9 = 0		
T10 = 18u	V10 = 0		

T1 = 0	V1 = 0	T11 = +1n	V11 = 3.3
T2 = 4u	V2 = 0	T12 = 26u	V12 = 3.3
T3 = +1n	V3 = 3.3	T13 = +1n	V13 = 0
T4 = 6u	V4 = 3.3	T14 = 28u	V14 = 0
T5 = +1n	V5 = 0	T15 = +1n	V15 = 3.3
T6 = 10u	V6 = 0	T16 = 32u	V16 = 3.3
T7 = +1n	V7 = 3.3	T17 = +1n	V17 = 0
T8 = 16u	V8 = 3.3		
T9 = +1n	V9 = 0		
T10 = 20u	V10 = 0		

出力のON/OFF時の伝搬遅延を計測します。

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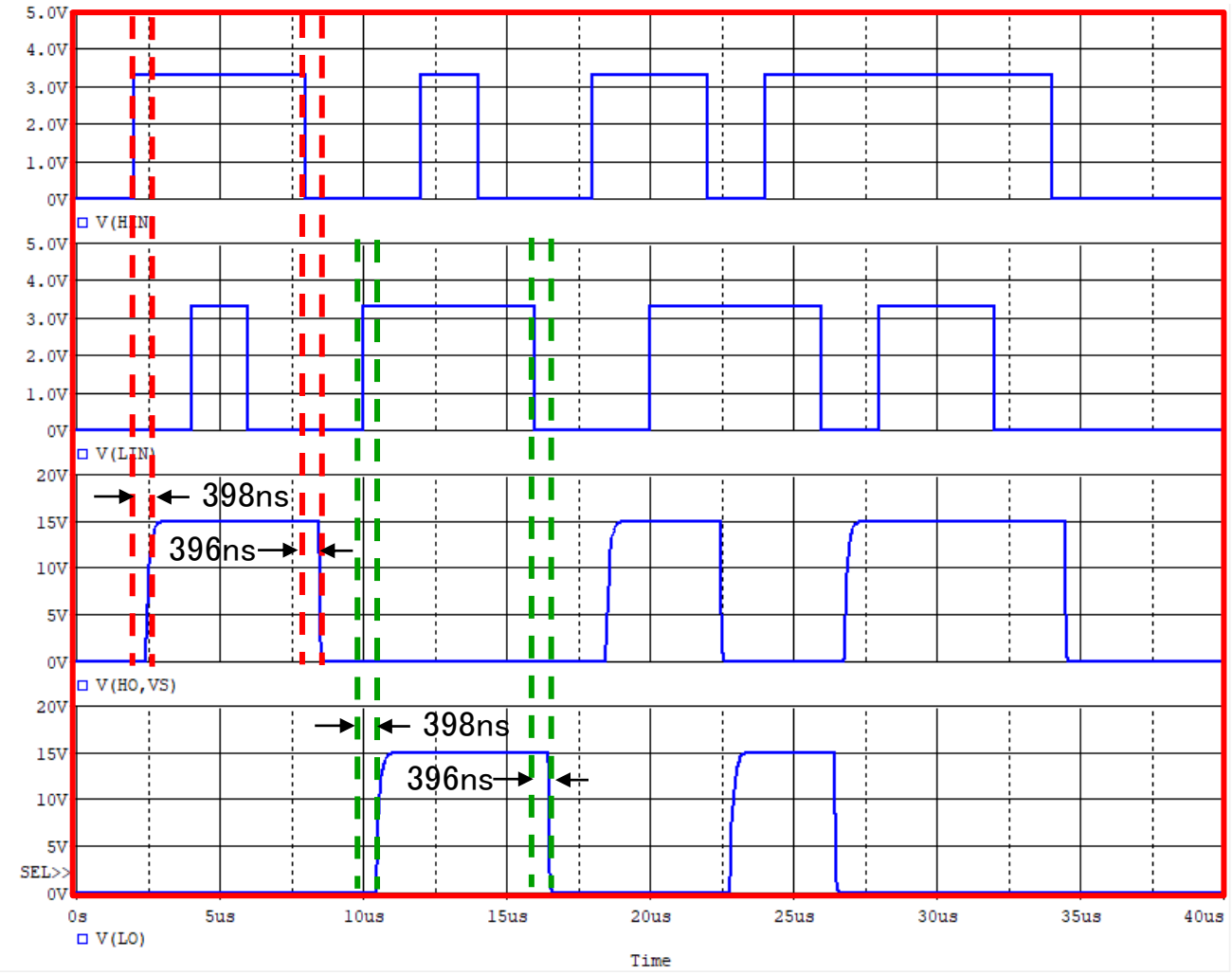
3.10.2 Turn-on/off propagation delay

HIN

LIN

HO-VS

LO



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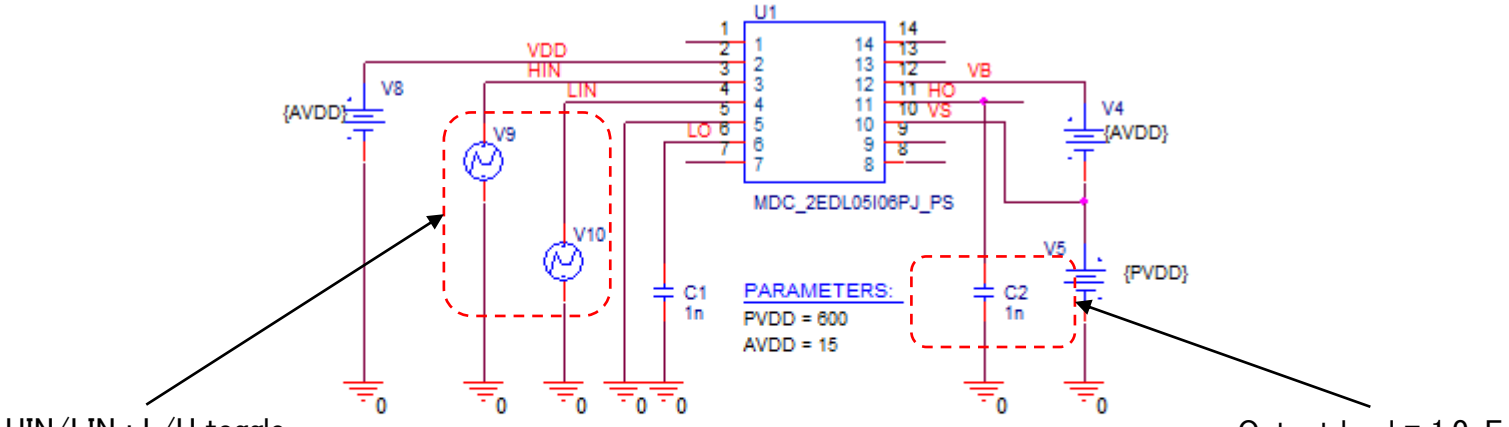
3.11.1 Turn-on rise time & Turn-off fall time



T1 = 0	V1 = 0	T11 = +1n	V11 = 3.3
T2 = 2u	V2 = 0	T12 = 22u	V12 = 3.3
T3 = +1n	V3 = 3.3	T13 = +1n	V13 = 0
T4 = 8u	V4 = 3.3	T14 = 24u	V14 = 0
T5 = +1n	V5 = 0	T15 = +1n	V15 = 3.3
T6 = 12u	V6 = 0	T16 = 34u	V16 = 3.3
T7 = +1n	V7 = 3.3	T17 = +1n	V17 = 0
T8 = 14u	V8 = 3.3		
T9 = +1n	V9 = 0		
T10 = 18u	V10 = 0		

T1 = 0	V1 = 0	T11 = +1n	V11 = 3.3
T2 = 4u	V2 = 0	T12 = 26u	V12 = 3.3
T3 = +1n	V3 = 3.3	T13 = +1n	V13 = 0
T4 = 6u	V4 = 3.3	T14 = 28u	V14 = 0
T5 = +1n	V5 = 0	T15 = +1n	V15 = 3.3
T6 = 10u	V6 = 0	T16 = 32u	V16 = 3.3
T7 = +1n	V7 = 3.3	T17 = +1n	V17 = 0
T8 = 16u	V8 = 3.3		
T9 = +1n	V9 = 0		
T10 = 20u	V10 = 0		

出力のON/OFF時の立上がり、立下り時間を
計測します。

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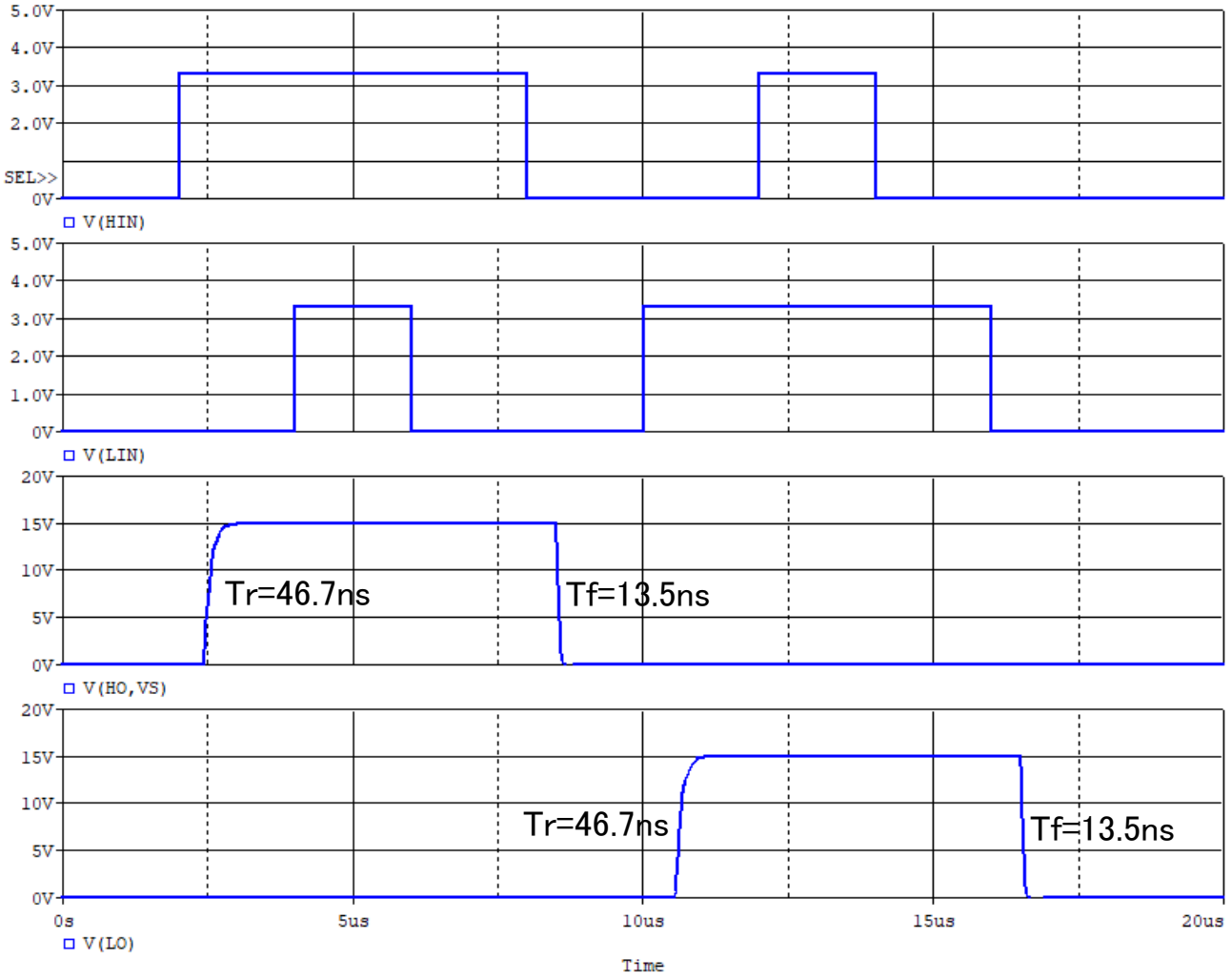
3.11.2 Turn-on rise time & Turn-off fall time

HIN

LIN

HO-VS

LO



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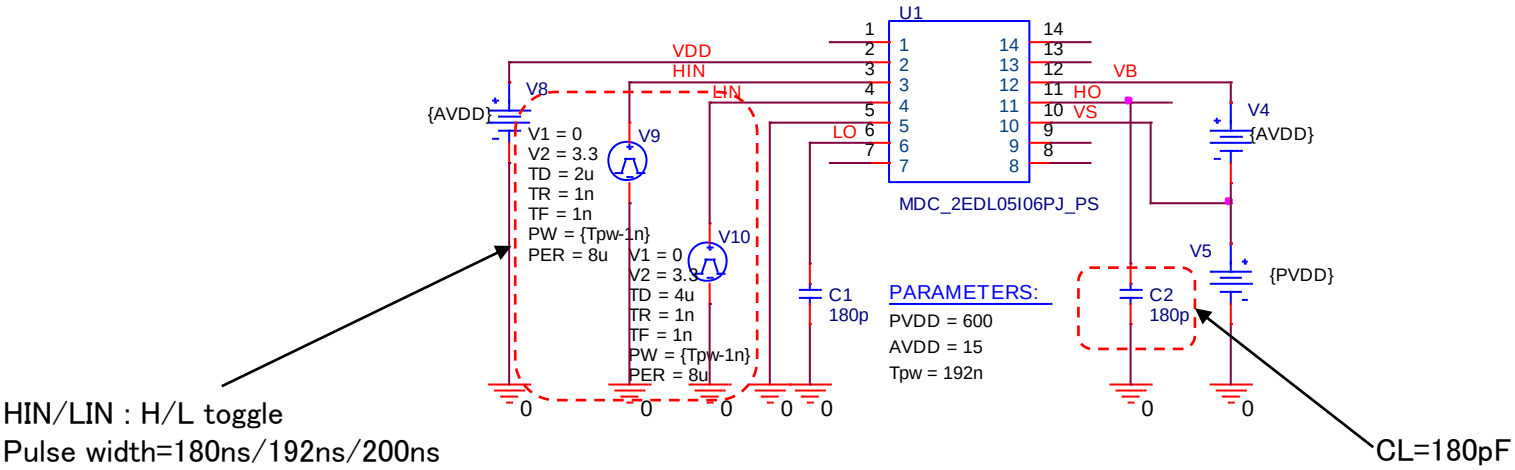
3.12.1 Input filter time at LIN/HIN for turn on and off



入力フィルター時間を計測します。

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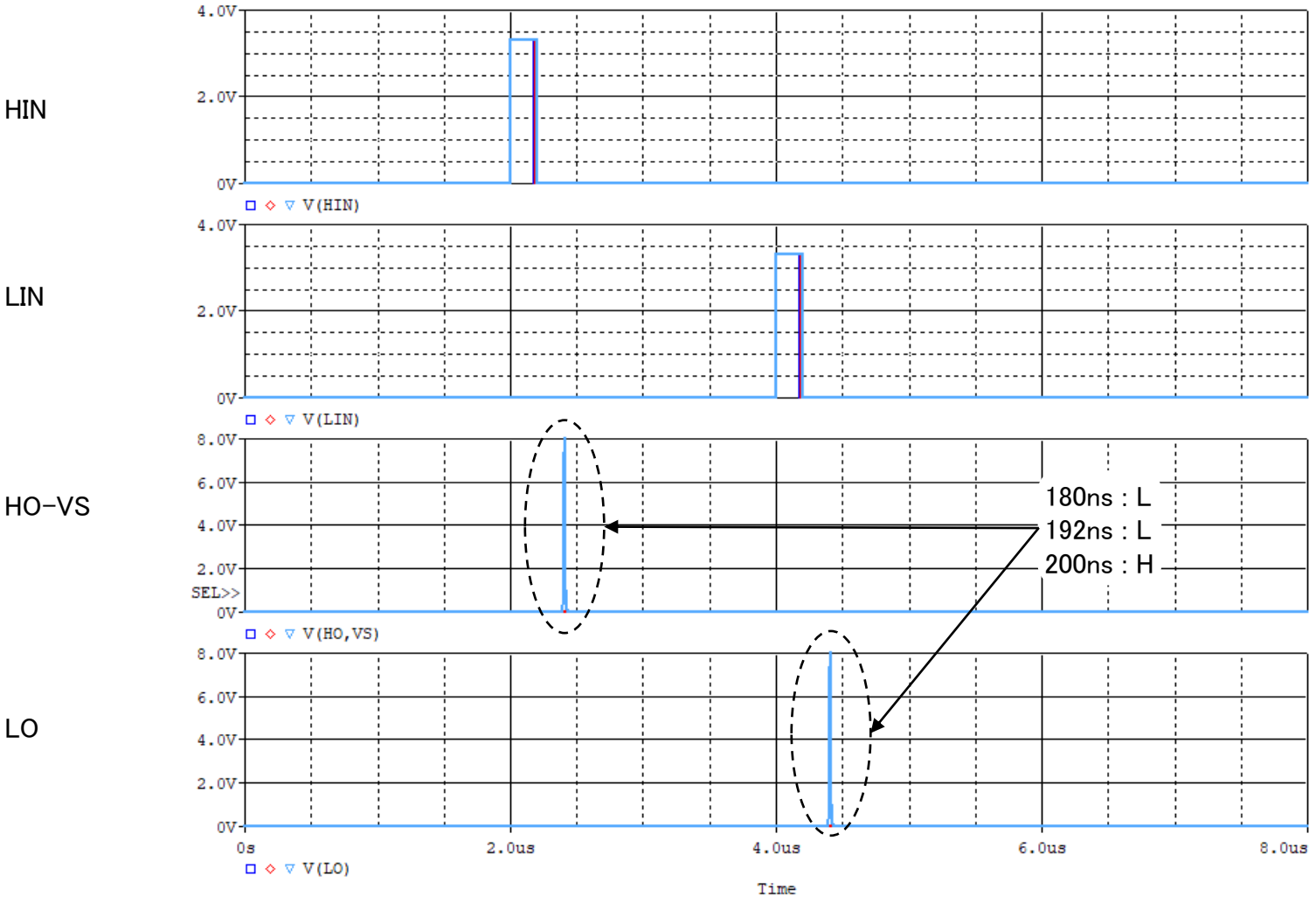
3.12.2 Input filter time at LIN/HIN for turn on and off



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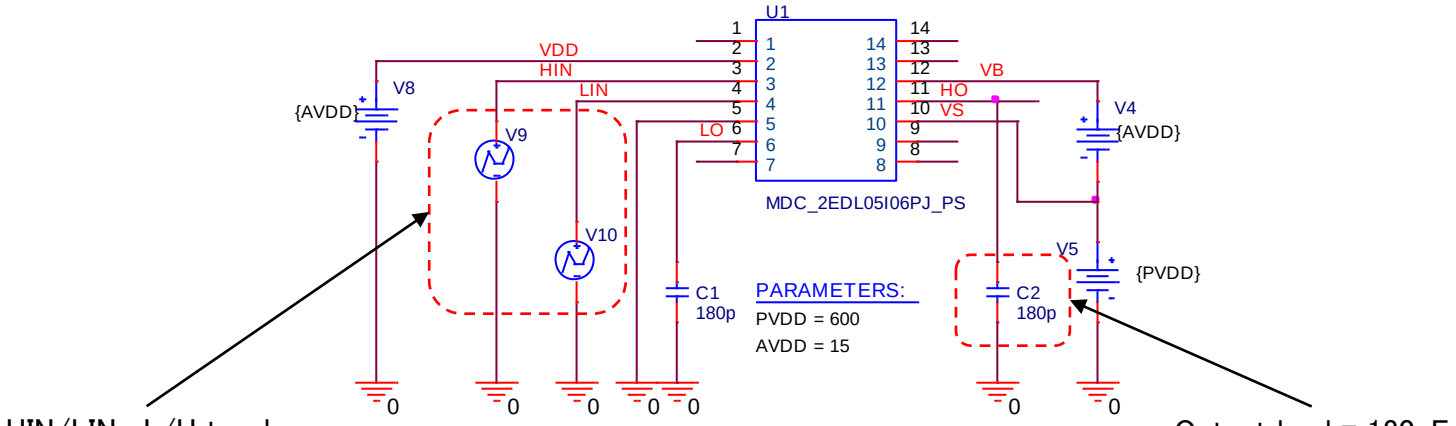
3.13.1 Dead time



T1 = 0	V1 = 0	T11 = +1n	V11 = 3.3
T2 = 2u	V2 = 0	T12 = 22u	V12 = 3.3
T3 = +1n	V3 = 3.3	T13 = +1n	V13 = 0
T4 = 8u	V4 = 3.3	T14 = 24u	V14 = 0
T5 = +1n	V5 = 0	T15 = +1n	V15 = 3.3
T6 = 12u	V6 = 0	T16 = 34u	V16 = 3.3
T7 = +1n	V7 = 3.3	T17 = +1n	V17 = 0
T8 = 14u	V8 = 3.3		
T9 = +1n	V9 = 0		
T10 = 18u	V10 = 0		

T1 = 0	V1 = 0	T11 = +1n	V11 = 3.3
T2 = 4u	V2 = 0	T12 = 26u	V12 = 3.3
T3 = +1n	V3 = 3.3	T13 = +1n	V13 = 0
T4 = 6u	V4 = 3.3	T14 = 28u	V14 = 0
T5 = +1n	V5 = 0	T15 = +1n	V15 = 3.3
T6 = 10u	V6 = 0	T16 = 32u	V16 = 3.3
T7 = +1n	V7 = 3.3	T17 = +1n	V17 = 0
T8 = 16u	V8 = 3.3		
T9 = +1n	V9 = 0		
T10 = 20u	V10 = 0		

出力に接続するスイッチングトランジスタの
同時ONを回避するためのDead Timeを
計測します。

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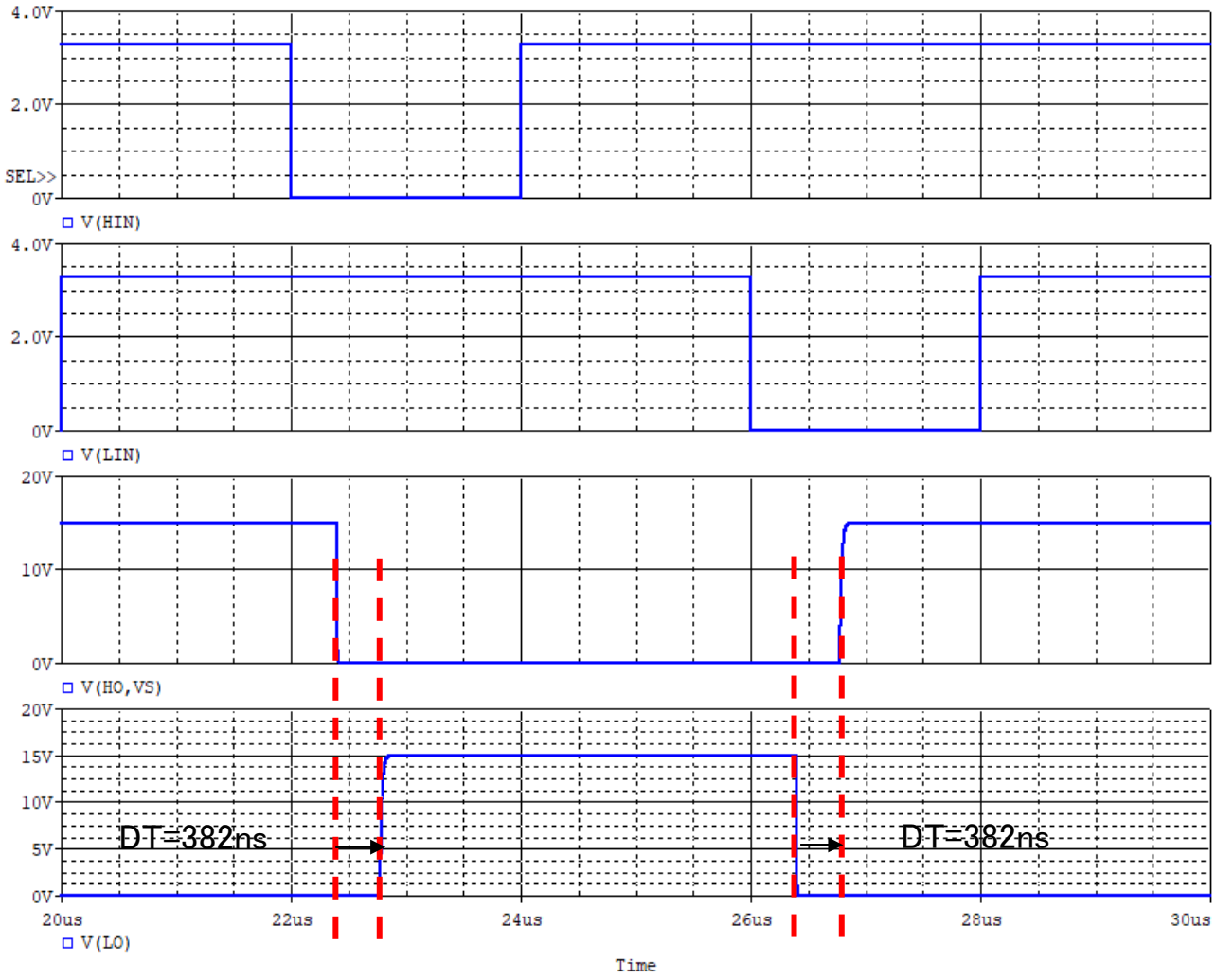
3.13.2 Dead time

HIN

LIN

HO−VS

LO



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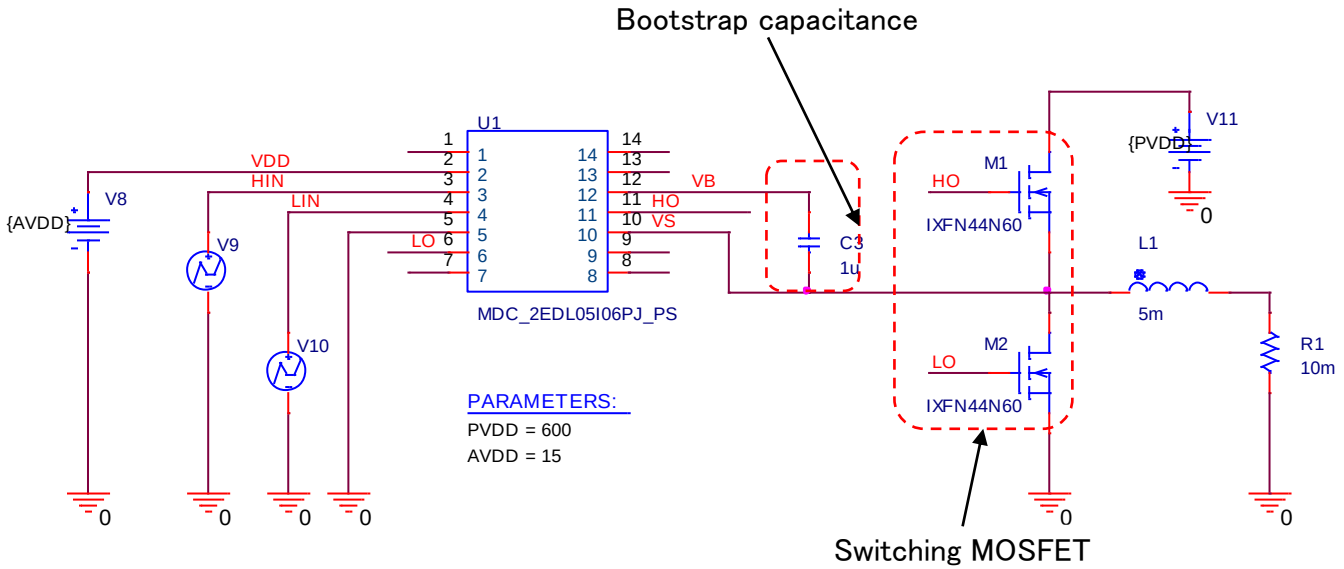
3.14.1 Function（Normal operation)



T1 = 0	V1 = 0	T11 = +1n	V11 = 3.3	T1 = 0	V1 = 0	T11 = +1n	V11 = 3.3
T2 = 2u	V2 = 0	T12 = 22u	V12 = 3.3	T2 = 4u	V2 = 0	T12 = 26u	V12 = 3.3
T3 = +1n	V3 = 3.3	T13 = +1n	V13 = 0	T3 = +1n	V3 = 3.3	T13 = +1n	V13 = 0
T4 = 8u	V4 = 3.3	T14 = 24u	V14 = 0	T4 = 6u	V4 = 3.3	T14 = 28u	V14 = 0
T5 = +1n	V5 = 0	T15 = +1n	V15 = 3.3	T5 = +1n	V5 = 0	T15 = +1n	V15 = 3.3
T6 = 12u	V6 = 0	T16 = 34u	V16 = 3.3	T6 = 10u	V6 = 0	T16 = 32u	V16 = 3.3
T7 = +1n	V7 = 3.3	T17 = +1n	V17 = 0	T7 = +1n	V7 = 3.3	T17 = +1n	V17 = 0
T8 = 14u	V8 = 3.3			T8 = 16u	V8 = 3.3		
T9 = +1n	V9 = 0			T9 = +1n	V9 = 0		
T10 = 18u	V10 = 0			T10 = 20u	V10 = 0		

出力にMOSFETを接続して
基本動作を計測します。

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3.14.2 Function (Normal operation)

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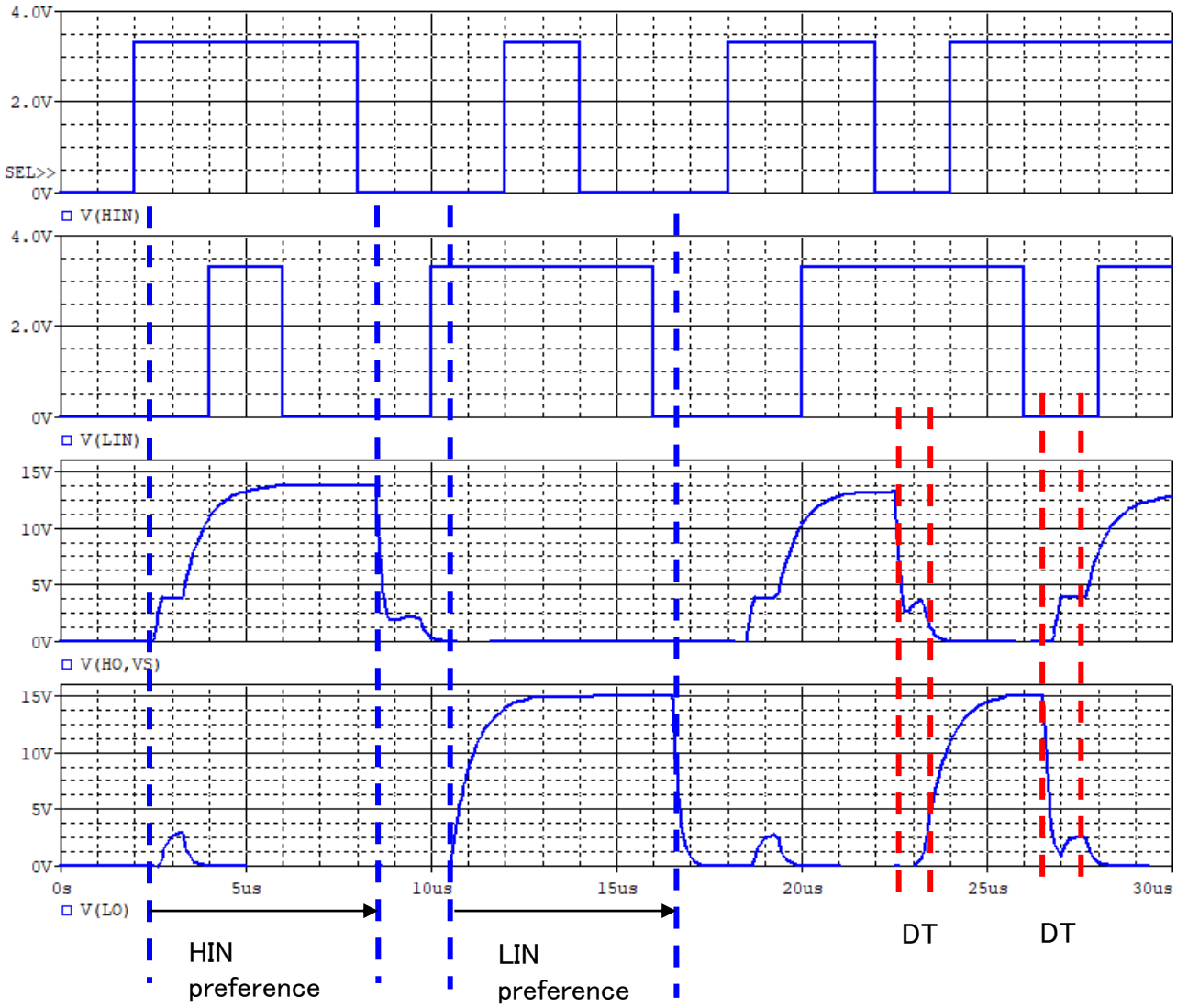

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