Smart High-Side Power Switch

Part number: BTS5016-1EKB

Draft V.1

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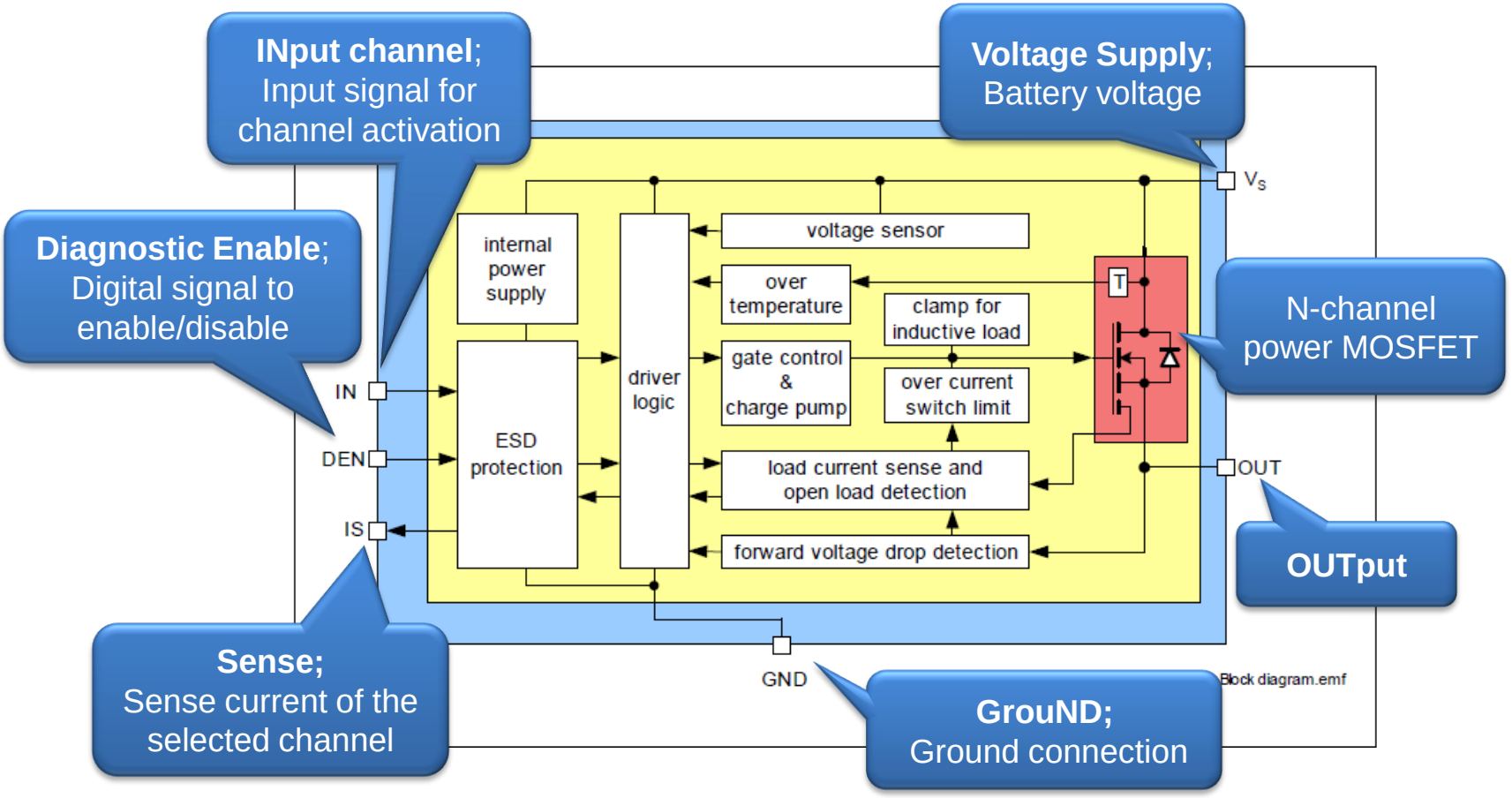
Block Diagram

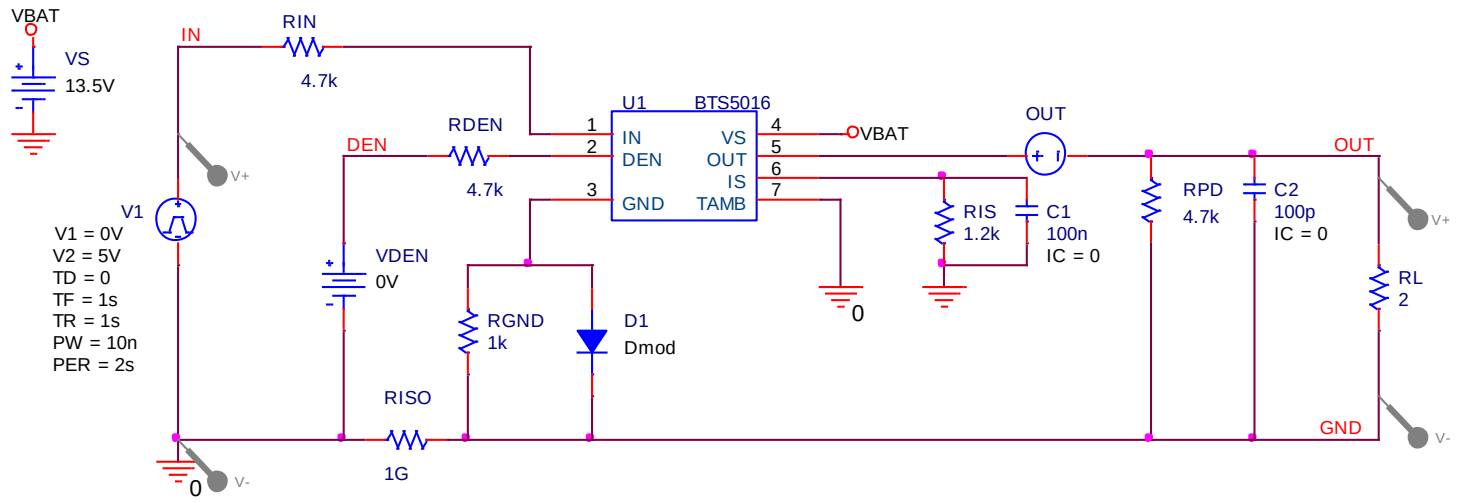


- The power transistor is built by an N-channel power MOSFET

Characteristics

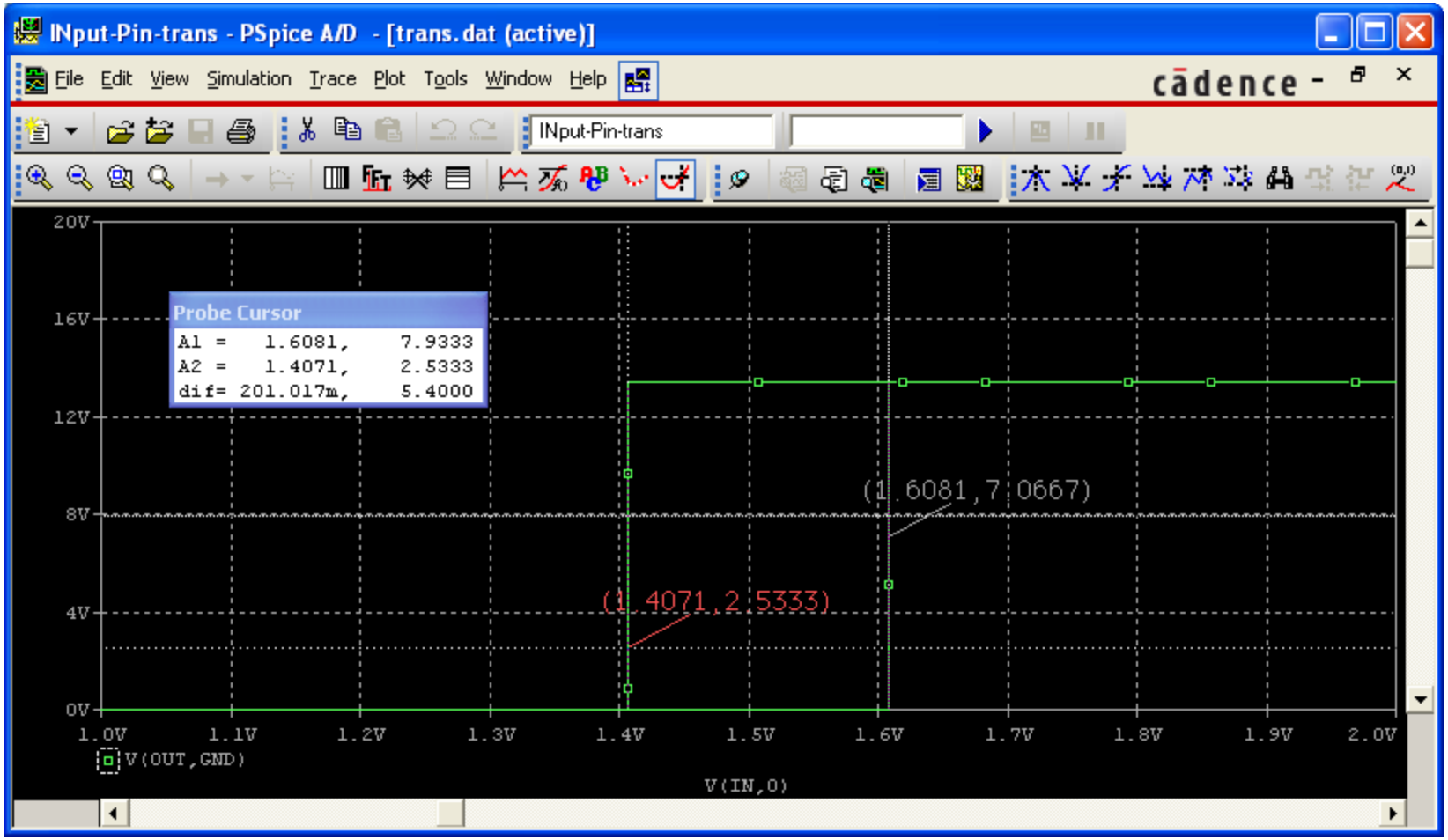
- **INput-Pin**
- **DEN-Pin**
- **Ron (ON-state resistance)**
- **Turn ON/OFF**

INput-Pin(1/3)



- Test Condition: VS=13.5V and RL=2Ω
- Analysis Type: Transient
- Simulation result and Comparison table show in next page

INput-Pin(2/3)



INput-Pin(3/3)

Table 9 Electrical Characteristics: Input Pins

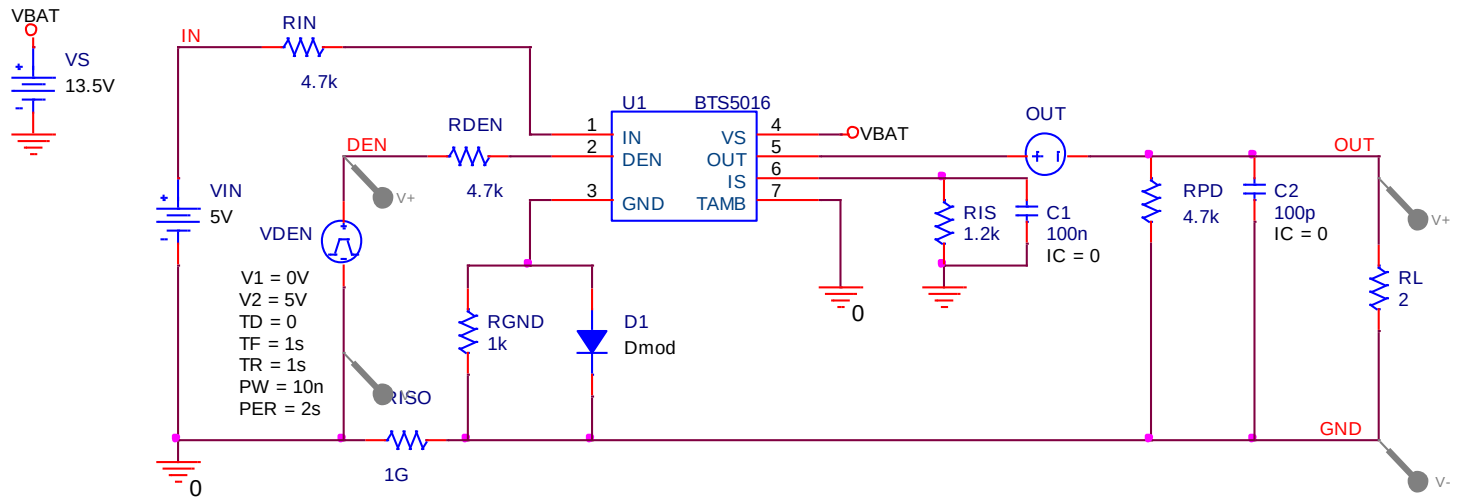
V_S = 8 V to 18 V, T_J = -40 °C to +150 °C (unless otherwise specified).
Typical values are given at V_S = 13.5 V, T_J = 25 °C

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
INput Pins Characteristics						
Low level input voltage range	$V_{IN(L)}$	-0.3	–	0.8	V	See **Figure 48**
High level input voltage range	$V_{IN(H)}$	2	–	6	V	See **Figure 49**
Input voltage hysteresis	$V_{IN(HYS)}$	–	250	–	mV	1) See **Figure 50**
Low level input current	$I_{IN(L)}$	1	10	25	µA	V_{IN} = 0.8 V
High level input current	$I_{IN(H)}$	2	10	25	µA	V_{IN} = 5.5 V See **Figure 51**

- Comparison Table

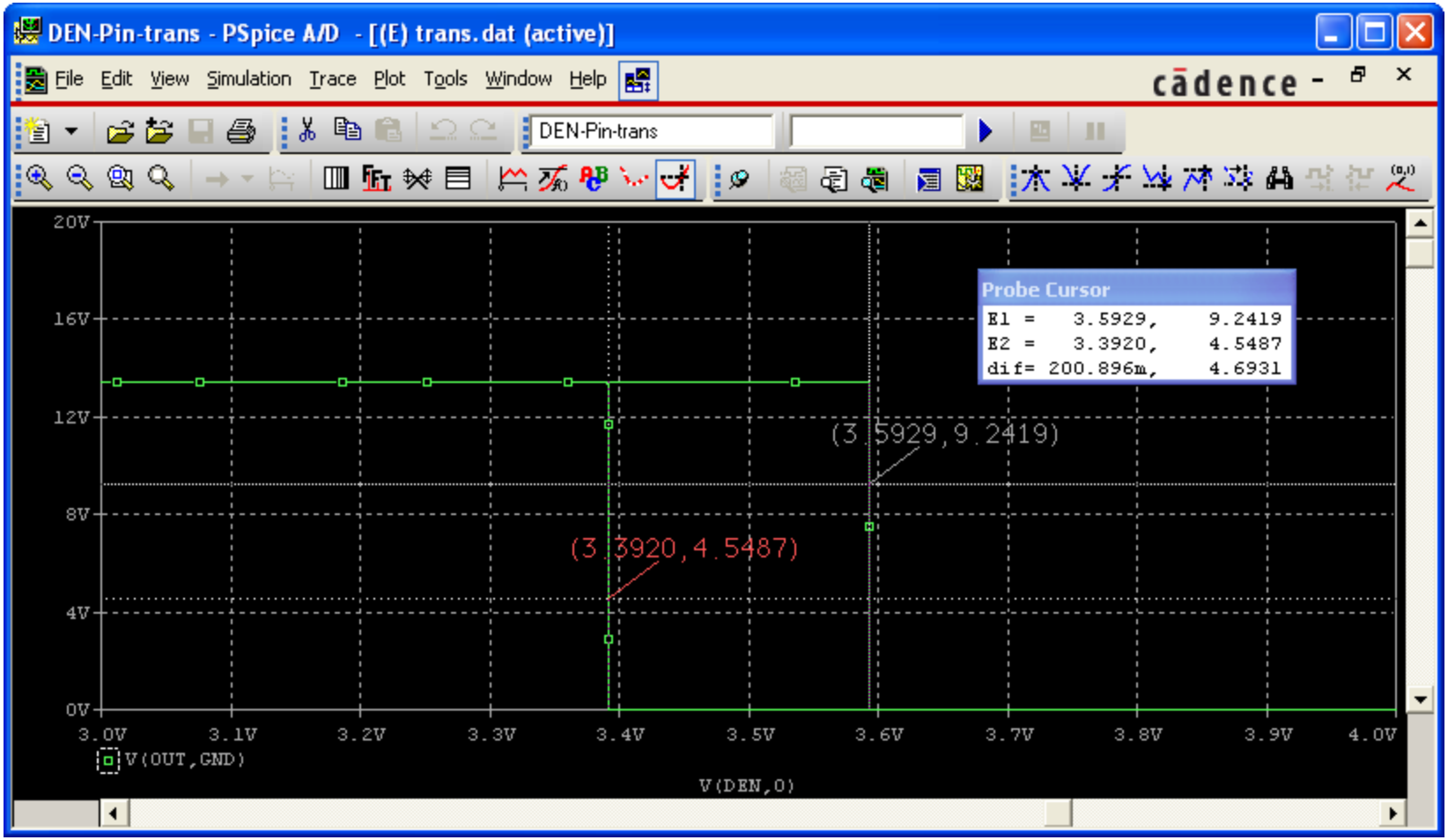
	Measurement	Simulation	%Error
VIN(L) (V)	0.800[Max]	1.470	83.76
VIN(H) (V)	2.000[Min]	1.608	-19.60
VIN(HYS) (mV)	250.000	201.017	-19.59

DEN-Pin(1/3)



- Test Condition: VS=13.5V and RL=2Ω
- Analysis Type: Transient
- Simulation result and Comparison table show in next page

DEN-Pin(2/3)



DEN-Pin(3/3)

Table 9 Electrical Characteristics: Input Pins

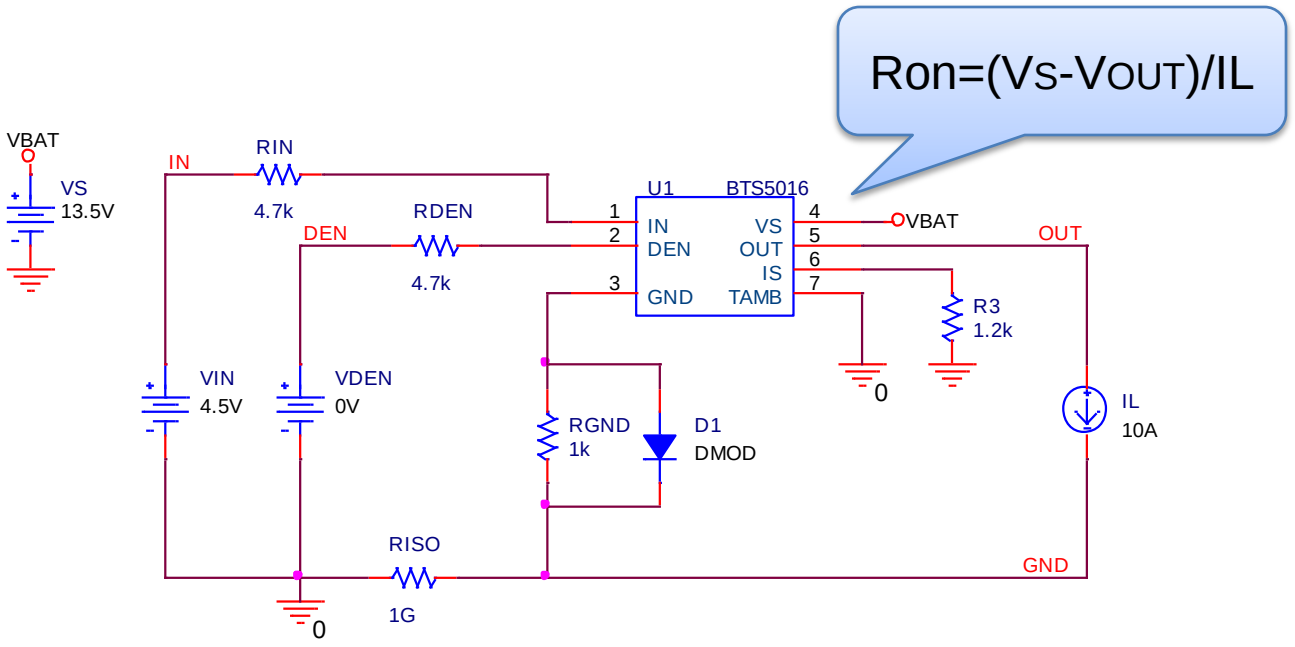
V_S = 8 V to 18 V, T_J = -40 °C to +150 °C (unless otherwise specified).
Typical values are given at V_S = 13.5 V, T_J = 25 °C

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
DEN Pin						
Low level input voltage range	$V_{DEN(L)}$	-0.3	–	0.8	V	–
High level input voltage range	$V_{DEN(H)}$	2	–	6	V	–
Input voltage hysteresis	$V_{DEN(HYS)}$	–	250	–	mV	1)
Low level input current	$I_{DEN(L)}$	1	10	25	µA	V_{DEN} = 0.8 V
High level input current	$I_{DEN(H)}$	2	10	25	µA	V_{DEN} = 5.5 V

- Comparison Table

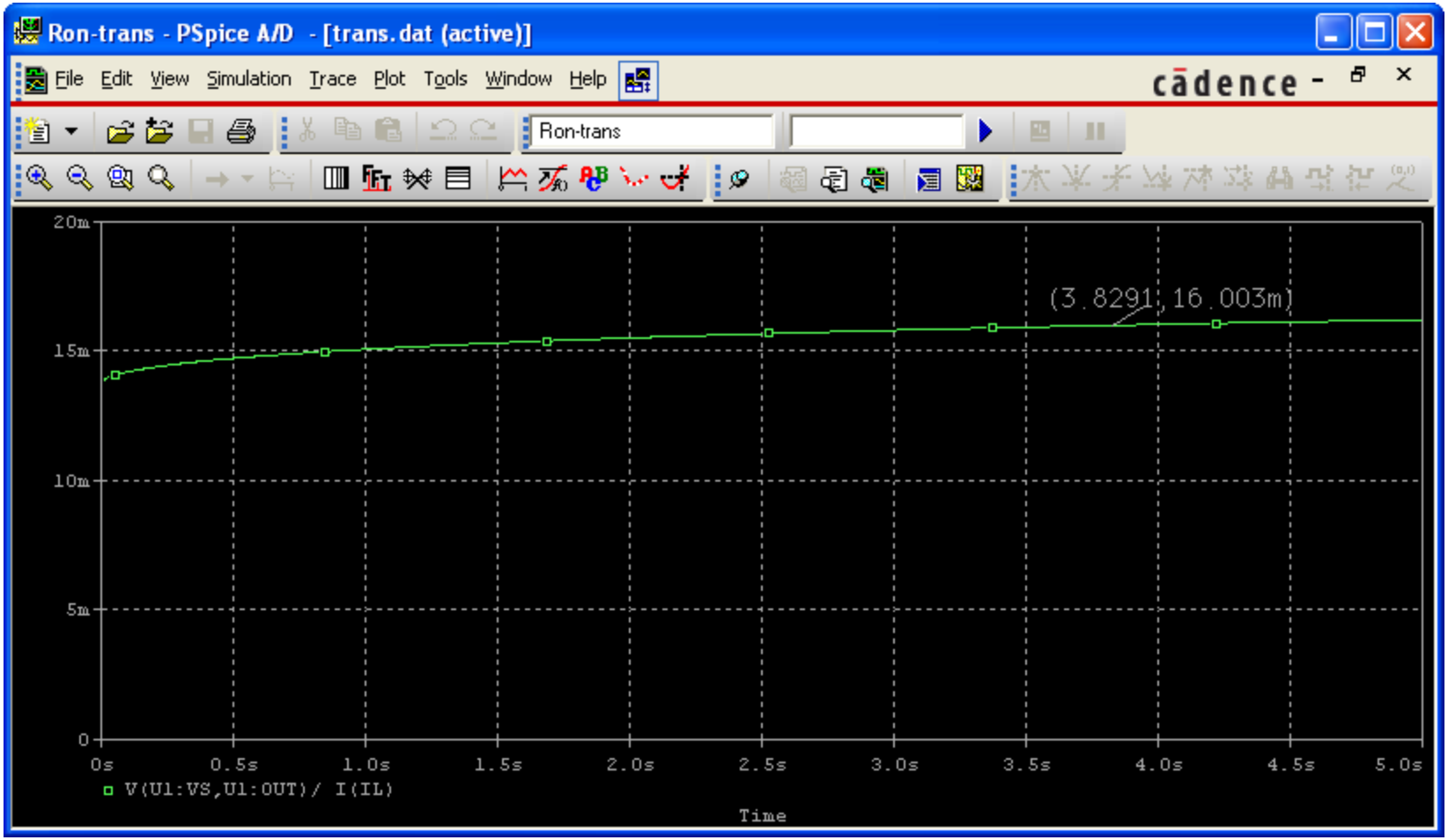
	Measurement	Simulation	%Error
VDEN(L) (V)	0.800[Max]	3.392	324.00
VDEN(H) (V)	2.000[Min]	3.593	79.65
VDEN(HYS) (mV)	250.000	200.896	-19.64

Ron (ON-state resistance)(1/3)



- Test Condition: IL=10A, VIN=4.5V and VS=13.5V
- Analysis Type: Transient
- Simulation result and Comparison table show in next page

Ron (ON-state resistance)(2/3)



Ron (ON-state resistance)(3/3)

Table 5 Electrical Characteristics: Power Stage

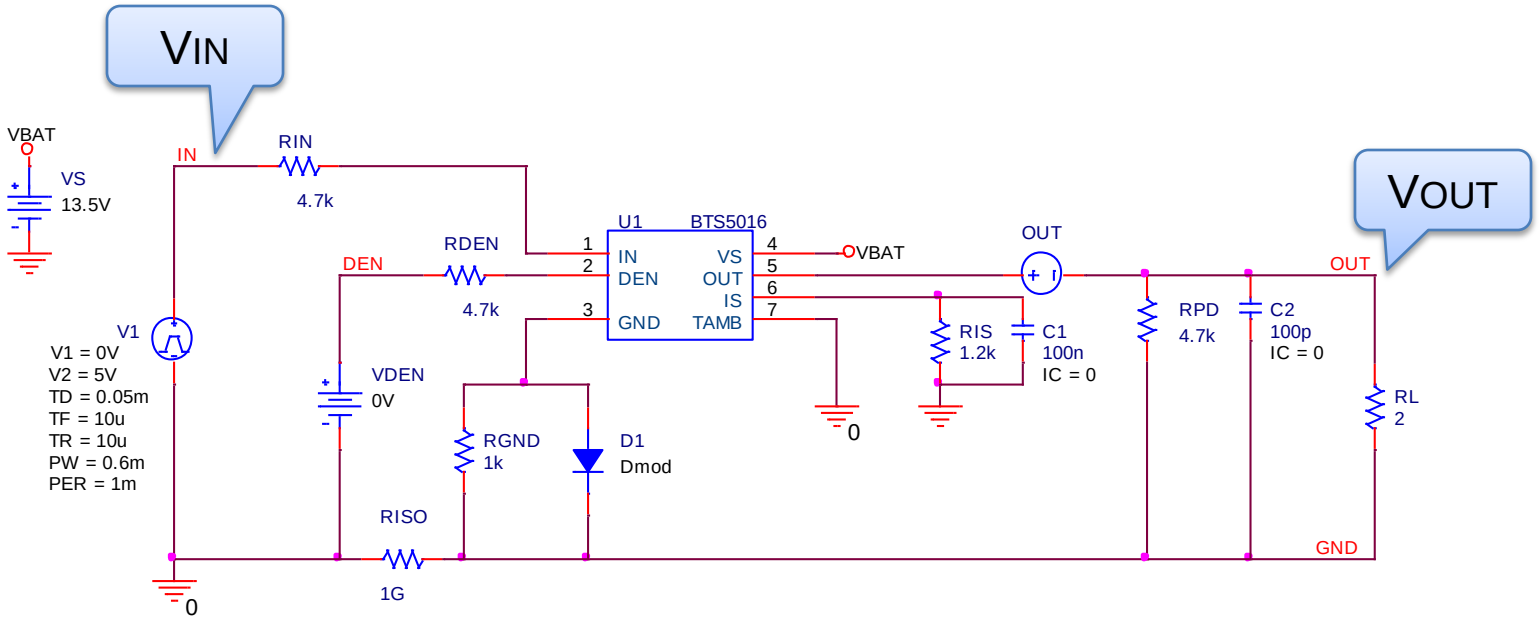
V_S = 8 V to 18 V, T_J = -40 °C to +150 °C (unless otherwise specified).
Typical values are given at V_S = 13.5 V, T_J = 25 °C

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
ON-state resistance per channel	$R_{DS(ON)\_150}$	21	28	32	mΩ	$I_L = I_{L4}$ = 10 A V_{IN} = 4.5 V T_J = 150 °C See Figure 8
ON-state resistance per channel	$R_{DS(ON)\_25}$	–	16	–	mΩ	1) T_J = 25 °C

	Measurement	Simulation	%Error
$R_{DS(on)[m\Omega]}$	16.000	16.003	0.02

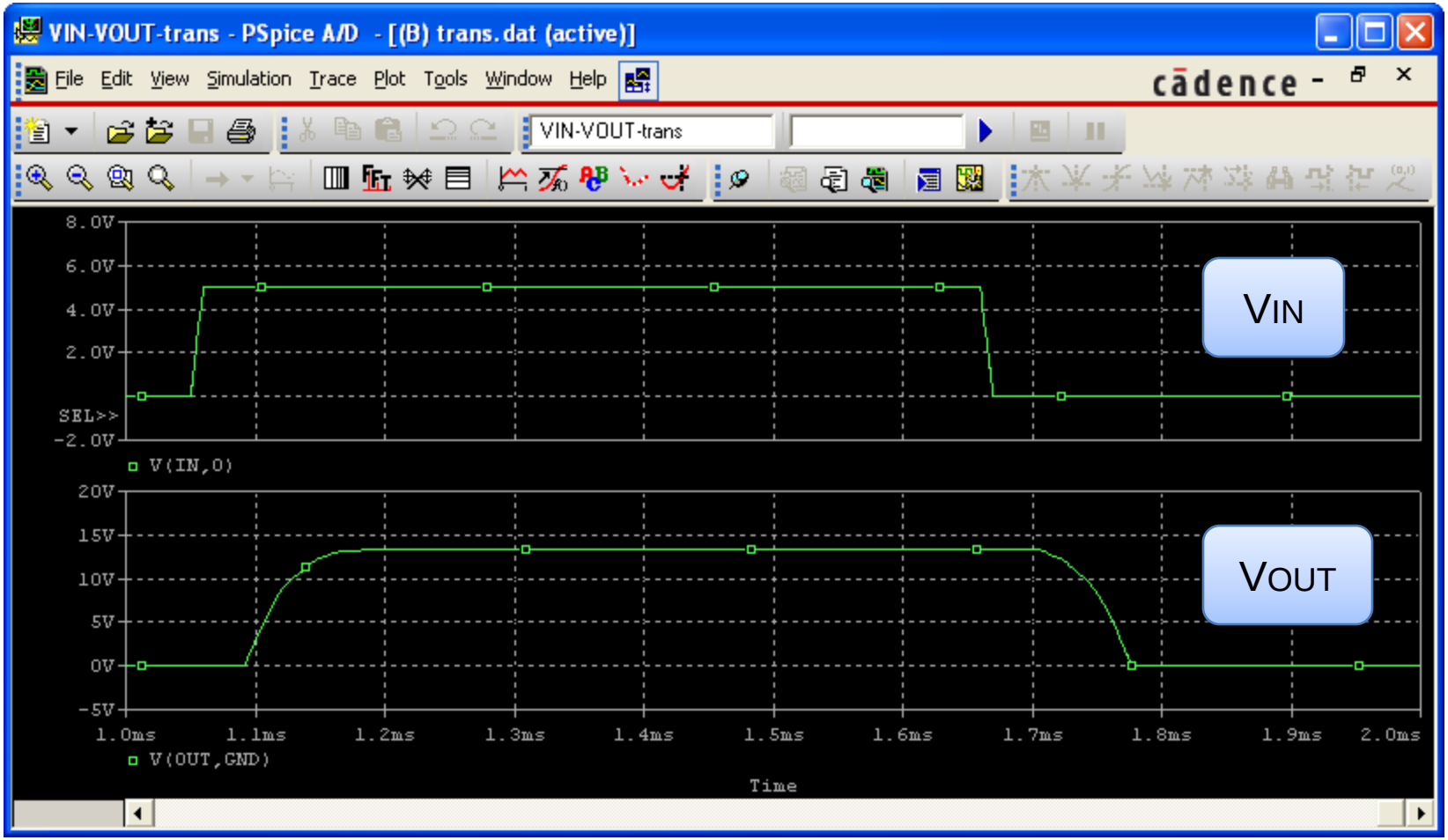
- Comparison Table

Turn ON/OFF(1/4)

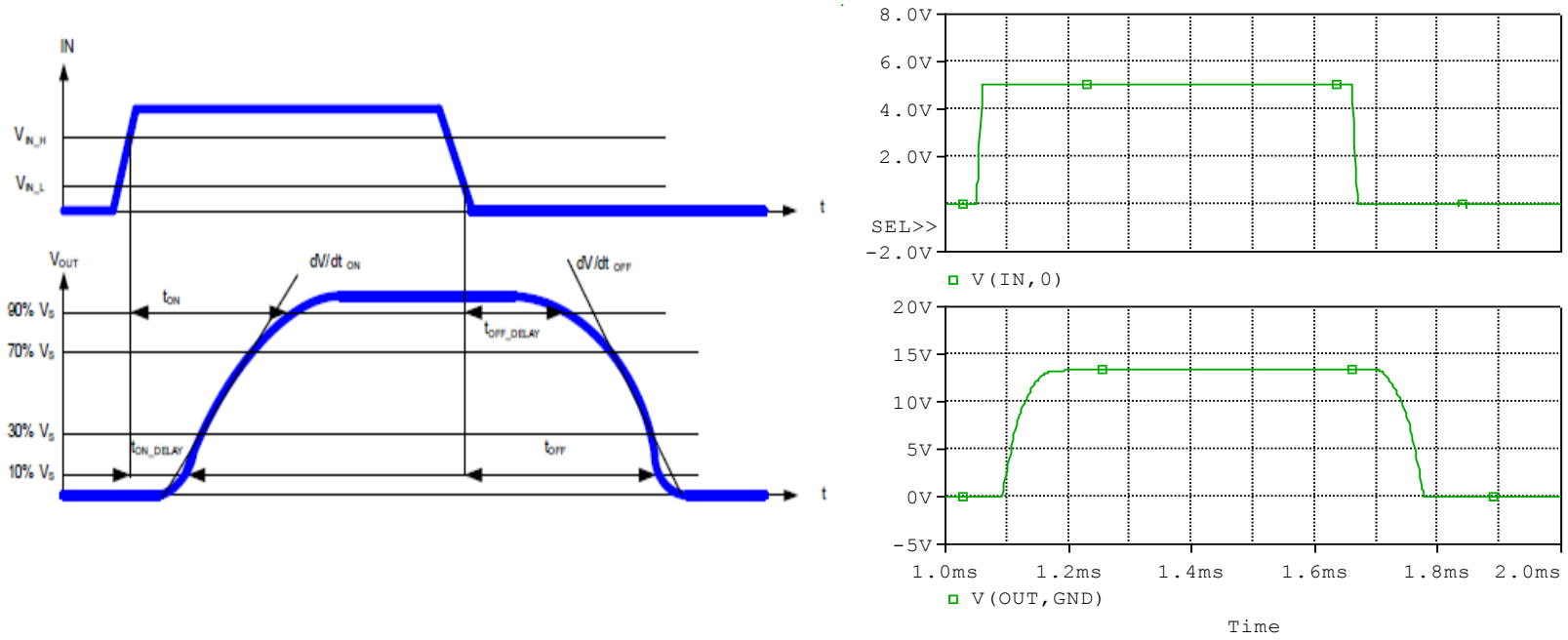


- Test Condition: VS=13.5V and RL=2Ω
- Analysis Type: Transient
- Simulation result and Comparison table show in next page

Turn ON/OFF(2/4)



Turn ON/OFF(3/4)



- **Figure 9** Switching a Resistive Load Timing (Page 15 from data sheet)

Turn ON/OFF(4/4)

Table 5 Electrical Characteristics: Power Stage

V_S = 8 V to 18 V, T_J = -40 °C to +150 °C (unless otherwise specified).
Typical values are given at V_S = 13.5 V, T_J = 25 °C

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Slew rate 30% to 70% V_S	dV/dt_{ON}	0.1	0.25	0.5	V/µs	R_L = 2 Ω V_S = 13.5 V See **Figure 9** See **Figure 35** See **Figure 36** See **Figure 37** See **Figure 38** See **Figure 39**
Slew rate 70% to 30% V_S	$-dV/dt_{OFF}$	0.1	0.25	0.5	V/µs	
Slew rate matching dV/dt_{ON} - dV/dt_{OFF}	$\Delta dV/dt$	-0.15	0	0.15	V/µs	
Turn-ON time to V_{OUT} = 90% V_S	t_{ON}	30	100	250	µs	
Turn-OFF time to V_{OUT} = 10% V_S	t_{OFF}	30	100	250	µs	
Turn-ON / OFF matching t_{OFF} - t_{ON}	Δt_{SW}	-50	-10	50	µs	
Turn-ON time to V_{OUT} = 10% V_S	t_{ON_delay}	10	60	120	µs	
Turn-OFF time to V_{OUT} = 90% V_S	t_{OFF_delay}	10	60	120	µs	

- Comparison Table

	Measurement	Simulation	%Error
dV/dton(V/us)	0.250	0.255	2.00
dV/dtoff(V/us)	0.250	0.247	-1.20
ΔdV/dt(V/us)	0.000	0.008	-
t_{on} (us)	100.000	89.842	-10.16
t_{oFF} (us)	100.000	104.194	4.19
Δtsw (us)	-10.000	14.352	-
t_{on_delay} (us)	60.000	36.525	-39.13
t_{off_delay} (us)	60.000	53.778	-10.37