NPS3005A/NPS3005B

0.5 V to 5.5 V, 6 A. 14 mΩ load switch with soft start, and optional quick-output discharge

Rev. 1 — 17 June 2026 Product data sheet

1. General description

NPS3005A/NPS3005B are single-channel, 6 A load switches with an adjustable soft start and a 0.5 V to 5.5 V input range. A low-voltage EN pin handles control down to 1 V, while an external 1.5 V to 5.5 V BIAS pin ensures stable on-resistance.

The adjustable soft start limits load inrush current making **NPS3005A/NPS3005B** well suited for power supply sequencing applications. Built-in thermal protection shuts off the device above 160°C and automatically re-enables it after a 20°C drop.

The NPS3005B variant includes an integrated 230 Ω resistor for Quick Output Discharge (QOD).

Both devices operates across a -40 °C to 125 °C ambient range and are housed in a thermally enhanced HWSON8 package.

2. Features and benefits

Table 1. Related devices

Type number	ENABLE	Quick-output discharge
NPS3005A	Active high	No
NPS3005B	Active high	Yes

- Bias voltage range: 1.5 V to 5.5 V
- Input voltage range: 0.5 V to 5.5 V
- Maximum continuous current (I_{MAX}):
  - 6 A at 105 °C
  - 4 A at 125 °C
- 14 mΩ (typical) on-resistance
- 1.2 V control logic compatible
- Adjustable soft start
- Thermal shutdown
- SOT8067-1 (HWSON8) with thermal pad (0.5 mm pitch; 2.0 mm x 2.0 mm x 0.75 mm body)
- Specified from -40 °C to 125 °C

3. Applications

- Solid State Drive (SSD)
- Notebooks and tablets
- Telecom/Networking/Datacom
- Set-top boxes
- Optical Modules
- Power supply sequencing

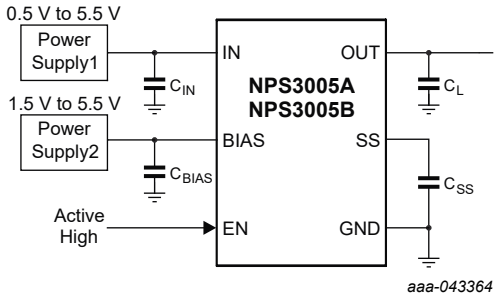


Fig. 1. Typical application circuit

4. Ordering information

Table 2. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
NPS3005AGP	-40 °C to 125 °C	HWSON8	Plastic thermal enhanced very very thin small outline package; no leads; 8 terminals; 0.5 mm pitch, 2.0 × 2.0 × 0.75 mm body	SOT8067-1
NPS3005BGP				

5. Marking

Table 3. Marking

Type number	Marking code
NPS3005AGP	s36
NPS3005BGP	s33

6. Selection guide

Table 4. Selection guide

Type number	Enable	R_{ON}	I_{MAX}	QOD
NPS3005AGP	Active high	14 mΩ	6 A	NO
NPS3005BGP	Active high	14 mΩ	6 A	YES

7. Functional diagram

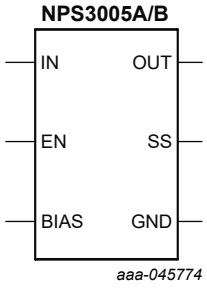


Fig. 2. Logic symbol

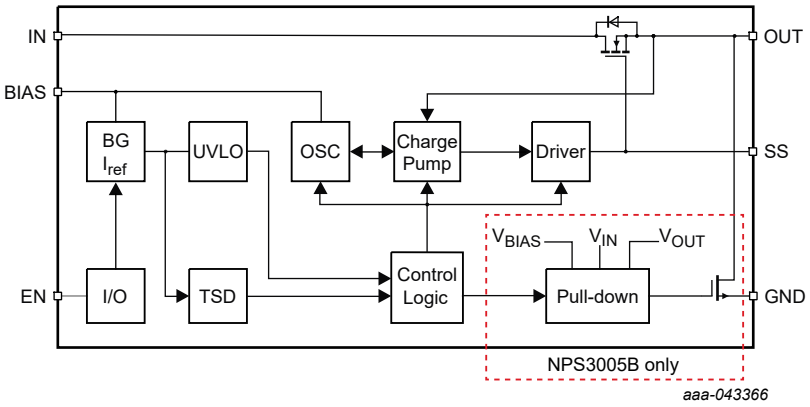
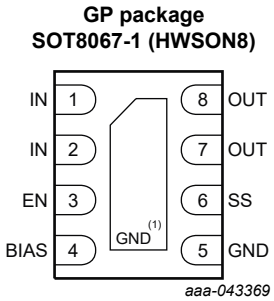


Fig. 3. Functional diagram

8. Pinning information

8.1. Pinning



Transparent top view

(1) No internal ground connection. The exposed center thermal pad must be tied to GND.

Fig. 4. Pin configuration SOT8076-1 (HWSON8)

8.2. Pin description

Table 5. Pin description

Symbol	Pin	IO	Description
IN	1, 2	I	Input power supply. At least 1 µF input bypass ceramic capacitor recommended for minimizing V_{IN} dip.
EN	3	I	Active-high enable input. Drive EN high to enable power switch. Drive EN low to disable. Drive this pin to valid high or low level. Do not leave floating.
BIAS	4	I	Supply voltage to internal control circuit.
GND	5		Ground pin of the circuitry. All voltage levels are measured with respect to this pin. Connect externally to power pad
SS	6	O	Soft start control of switch. A capacitor from this pin to ground sets the V_{OUT} rise slew rate.
OUT	7, 8	O	Output to the load.
PAD	-	PAD	The exposed thermal pad is used primarily for heat dissipation. Connect the thermal pad to ground externally to have better thermal performance.

9. Limiting values

Table 6. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).[1]

Symbol	Parameter	Conditions	Min	Max	Unit
V_{IN}	input voltage		–0.3	6	V
V_{OUT}	output voltage		–0.3	6	V
V_{BIAS}	bias voltage		–0.3	6	V
V_{EN}	enable voltage		–0.3	6	V
I_{MAX}	maximum continuous switch current	ambient temperature: -40 °C to 105 °C	-	6	A
		ambient temperature: -40 °C to 125 °C	-	4	A
I_{PLS}	maximum pulsed switch current	pulse <300 µs; 2% duty cycle	-	8	A
T_j	junction temperature		-	150	°C
T_{stg}	storage temperature		–65	150	°C

[1] Stresses beyond those listed under Limiting values may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

10. ESD ratings

Table 7. ESD ratings

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{ESD}	electrostatic discharge voltage	HBM: ANSI/ESDA/JEDEC JS-001 class 2	-3000	-	3000	V
		CDM: ANSI/ESDA/JEDEC JS-002 class C3	-1500	-	1500	V

11. Recommended operating conditions

Table 8. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V_{IN}	input voltage		0.5	5.5	V
V_{BIAS}	bias voltage		1.5	5.5	V
V_{EN}	enable voltage		0	5.5	V
V_{OUT}	output voltage		-	V_{IN}	V
V_{IH}	HIGH level input voltage EN pin	-40 °C to 105 °C	1	5.5	V
		-40 °C to 125 °C	1.3	5.5	V
V_{IL}	LOW level input voltage EN pin		0	0.4	V
T_{amb}	ambient temperature		–40	125	°C

12. Recommended components

Table 9. Recommended components

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_{IN}	capacitor on pin IN		-	1	-	µF
C_{OUT}	capacitor on pin OUT		-	0.1	-	µF
C_{BIAS}	capacitor on pin BIAS		-	1	-	µF
C_{SS}	capacitor on pin SS		0	-	100	nF

13. Thermal Information

Table 10. Thermal information

Symbol	Parameter	SOT8067-1 (HWSON8)	Unit
$R_{\Theta JA}$	junction-to-ambient thermal resistance	152	° C/W
$R_{\Theta JC(top)}$	junction-to-case (top) thermal resistance	132	° C/W
Ψ_{JT}	junction-to-top characterization parameter	13	° C/W
Ψ_{JB}	junction-to-board characterization parameter	6.9	° C/W

14. Static characteristics

Table 11. Static characteristics

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

Symbol	Parameter	Conditions	T_{amb}	Min	Typ	Max	Unit
Power supply and current, V_{BIAS} = 5 V							
$I_{Q(BIAS)}$	quiescent current	BIAS pin; no load; V_{IN} = V_{EN} = 5 V	–40 °C to 125 °C	-	47	90	µA
$I_{SD(BIAS)}$	shutdown current	BIAS pin; V_{EN} = V_{OUT} = 0 V	–40 °C to 125 °C	-	0.003	2.3	µA
$I_{SD(IN)}$	off-state supply current	IN pin; V_{EN} = V_{OUT} = 0 V					
		V_{IN} = 5 V	–40 °C to 125 °C	-	0.013	22	µA
		V_{IN} = 3.3 V	–40 °C to 125 °C	-	0.008	15	µA
		V_{IN} = 1.8 V	–40 °C to 125 °C	-	0.006	8.5	µA
		V_{IN} = 0.5 V	–40 °C to 125 °C	-	0.004	7	µA
I_{EN}	input leakage current	EN pin; V_{EN} = 5.5 V	–40 °C to 125 °C	-	-	0.1	µA
$V_{EN(hys)}$	input hysteresis voltage	EN pin; V_{IN} = 5 V	–40 °C to 125 °C	-	85	-	mV
R_{PD}	output pull-down resistance	V_{IN} = 5 V, V_{EN} = 0 V	–40 °C to 125 °C	-	230	320	Ω
T_{SD}	thermal shutdown	junction temperature rising	-	-	160	-	°C
$T_{SD(hys)}$	thermal shutdown hysteresis	junction temperature falling	-	-	20	-	°C
Power supply and current, V_{BIAS} = 2.5 V							
$I_{Q(BIAS)}$	quiescent current	BIAS pin; no load; V_{IN} = V_{EN} = 2.5 V	–40 °C to 125 °C	-	23	40	µA
$I_{SD(BIAS)}$	shutdown current	BIAS pin; V_{EN} = V_{OUT} = 0 V	–40 °C to 125 °C	-	0.002	1	µA

Symbol	Parameter	Conditions	T_{amb}	Min	Typ	Max	Unit
$I_{SD(IN)}$	off-state supply current	IN pin; $V_{EN} = V_{OUT} = 0$ V					
		V_{IN} = 2.5 V	–40 °C to 125 °C	-	0.006	9.5	µA
		V_{IN} = 1.8 V	–40 °C to 125 °C	-	0.005	8.5	µA
		V_{IN} = 0.5 V	–40 °C to 125 °C	-	0.004	7	µA
I_{EN}	input leakage current	EN pin; V_{EN} = 5.5 V	–40 °C to 125 °C	-	-	0.1	µA
$V_{EN(hys)}$	input hysteresis voltage	EN pin; V_{IN} = 2.5 V	–40 °C to 125 °C	-	85	-	mV
R_{PD}	output pull-down resistance	V_{IN} = 2.5 V, V_{EN} = 0 V	–40 °C to 125 °C	-	230	340	Ω
T_{SD}	thermal shutdown	junction temperature rising	-	-	160	-	°C
$T_{SD(hys)}$	thermal shutdown hysteresis	junction temperature falling	-	-	20	-	°C
Power supply and current, V_{BIAS} = 2 V							
$I_{Q(BIAS)}$	quiescent current	BIAS pin; no load; $V_{IN} = V_{EN}$ = 2 V	–40 °C to 125 °C	-	21	35	µA
$I_{SD(BIAS)}$	shutdown current	BIAS pin; $V_{EN} = V_{OUT} = 0$ V	–40 °C to 125 °C	-	0.001	1	µA
$I_{SD(IN)}$	off-state supply current	IN pin; $V_{EN} = V_{OUT} = 0$ V					
		V_{IN} = 2 V	–40 °C to 125 °C	-	0.005	9.5	µA
		V_{IN} = 1.8 V	–40 °C to 125 °C	-	0.004	8.5	µA
		V_{IN} = 1.2 V	–40 °C to 125 °C	-	0.004	8	µA
		V_{IN} = 0.5 V	–40 °C to 125 °C	-	0.003	7	µA
I_{EN}	input leakage current	EN pin; V_{EN} = 5.5 V	–40 °C to 125 °C	-	-	0.1	µA
$V_{EN(hys)}$	input hysteresis voltage	EN pin; V_{IN} = 2 V	–40 °C to 125 °C	-	77	-	mV
R_{PD}	output pull-down resistance	V_{IN} = 2 V, V_{EN} = 0 V	–40 °C to 125 °C	-	230	360	Ω
T_{SD}	thermal shutdown	junction temperature rising	-	-	160	-	°C
$T_{SD(hys)}$	thermal shutdown hysteresis	junction temperature rising	-	-	20	-	°C
Power supply and current, V_{BIAS} = 1.5 V							
$I_{Q(BIAS)}$	quiescent current	BIAS pin; no load; $V_{IN} = V_{EN}$ = 2 V	–40 °C to 125 °C	-	-	35	µA
$I_{SD(BIAS)}$	shutdown current	BIAS pin; $V_{EN} = V_{OUT} = 0$ V	–40 °C to 125 °C	-	0.002	1	µA
$I_{SD(IN)}$	off-state supply current	IN pin; $V_{EN} = V_{OUT} = 0$ V					
		V_{IN} = 1.5 V	–40 °C to 125 °C	-	0.004	8.5	µA
		V_{IN} = 0.5 V	–40 °C to 125 °C	-	0.002	7	µA
I_{EN}	input leakage current	EN pin; V_{EN} = 5.5 V	–40 °C to 125 °C	-	-	0.1	µA
$V_{EN(hys)}$	input hysteresis voltage	EN pin; V_{IN} = 1.5 V	–40 °C to 125 °C	-	65	-	mV
R_{PD}	output pull-down resistance	V_{IN} = 1.5 V, V_{EN} = 0 V	–40 °C to 125 °C	-	230	440	Ω
T_{SD}	thermal shutdown	junction temperature rising	-	-	160	-	°C

Symbol	Parameter	Conditions	T_{amb}	Min	Typ	Max	Unit
$T_{SD(hys)}$	thermal shutdown hysteresis	junction temperature rising	-	-	20	-	°C
ON resistance (R_{ON}), V_{BIAS} = 5 V							
R_{ON}	ON resistance	I_{OUT} = –200 mA, V_{BIAS} = 5 V					
		V_{IN} = 5 V	–40 °C to 125 °C	-	14	25	mΩ
		V_{IN} = 3.3 V	–40 °C to 125 °C	-	14	25	mΩ
		V_{IN} = 2.5 V	–40 °C to 125 °C	-	14	25	mΩ
		V_{IN} = 1.8 V	–40 °C to 125 °C	-	14	25	mΩ
		V_{IN} = 1.5 V	–40 °C to 125 °C	-	14	25	mΩ
		V_{IN} = 1.2 V	–40 °C to 125 °C	-	14	25	mΩ
		V_{IN} = 0.5 V	–40 °C to 125 °C	-	14	25	mΩ
ON resistance (R_{ON}); V_{BIAS} = 2.5 V							
R_{ON}	ON resistance	I_{OUT} = –200 mA, V_{BIAS} = 2.5 V					
		V_{IN} = 2.5 V	–40 °C to 125 °C	-	14	34	mΩ
		V_{IN} = 1.8 V	–40 °C to 125 °C	-	14	31	mΩ
		V_{IN} = 1.5 V	–40 °C to 125 °C	-	14	30	mΩ
		V_{IN} = 1.2 V	–40 °C to 125 °C	-	14	29	mΩ
		V_{IN} = 0.5 V	–40 °C to 125 °C	-	14	27	mΩ
ON resistance (R_{ON}); V_{BIAS} = 2 V							
R_{ON}	ON resistance	I_{OUT} = –200 mA, V_{BIAS} = 2 V					
		V_{IN} = 1.8 V	–40 °C to 125 °C	-	14	35	mΩ
		V_{IN} = 1.2 V	–40 °C to 125 °C	-	14	35	mΩ
		V_{IN} = 0.5 V	–40 °C to 125 °C	-	14	35	mΩ
ON resistance (R_{ON}); V_{BIAS} = 1.5 V							
R_{ON}	ON resistance	I_{OUT} = –200 mA, V_{BIAS} = 1.5 V					
		V_{IN} = 1.5 V	–40 °C to 125 °C	-	14	36	mΩ
		V_{IN} = 1.2 V	–40 °C to 125 °C	-	14	36	mΩ
		V_{IN} = 0.5 V	–40 °C to 125 °C	-	14	36	mΩ

15. Dynamic characteristics

Table 12. Dynamic characteristics

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

Symbol	Parameter	Conditions	T_{amb} = 25 °C			Unit
			Min	Typ	Max	
t_{ON}	turn ON time	R_L = 10 Ω, C_L = 0.1 µF, C_{IN} = 1 µF, C_{SS} = 1 nF, V_{EN} = 5 V, 50% V_{EN} to 50% V_{OUT}				
		V_{IN} = V_{BIAS} = 5 V	-	1350	-	µs
		V_{IN} = V_{BIAS} = 2.5	-	950	-	µs
t_{OFF}	turn OFF time	R_L = 10 Ω, C_L = 0.1 µF, C_{IN} = 1 µF, C_{SS} = 1 nF, V_{EN} = 5 V, 50% V_{EN} to 50% V_{OUT}				
		V_{IN} = V_{BIAS} = 5 V	-	0.8	-	µs
		V_{IN} = V_{BIAS} = 2.5	-	1	-	µs

Symbol	Parameter	Conditions	T_{amb} = 25 °C			Unit
			Min	Typ	Max	
t_R	output rise time	R_L = 10 Ω, C_L = 0.1 µF, C_{IN} = 1 µF, C_{SS} = 1 nF, V_{EN} = 5 V, 10% V_{EN} to 90% V_{OUT}				
		V_{BIAS} = 5 V, V_{IN} = 1.5 V	-	480	-	µs
		V_{BIAS} = 5 V, V_{IN} = 1.8 V	-	565	-	µs
		V_{BIAS} = 5 V, V_{IN} = 3.3 V	-	985	-	µs
		V_{BIAS} = 5 V, V_{IN} = 5 V	-	1460	-	µs
		V_{BIAS} = 2.5 V, V_{IN} = 2.5 V	-	760	-	µs
t_F	output fall time	R_L = 10 Ω, C_L = 0.1 µF, C_{IN} = 1 µF, C_{SS} = 1 nF, V_{EN} = 5 V, 90% V_{EN} to 10% V_{OUT}				
		V_{BIAS} = 5 V, V_{IN} = 5 V	-	2	-	µs
		V_{BIAS} = 2.5 V, V_{IN} = 2.5 V	-	2	-	µs
$t_{D(EN)}$	EN delay time	R_L = 10 Ω, C_L = 0.1 µF, C_{IN} = 1 µF, C_{SS} = 1 nF, V_{EN} = 5 V, 50% V_{EN} to 10% V_{OUT}				
		V_{BIAS} = 5 V, V_{IN} = 5 V	-	640	-	µs
		V_{BIAS} = 2.5 V, V_{IN} = 2.5 V	-	570	-	µs

15.1. Waveform and test circuit

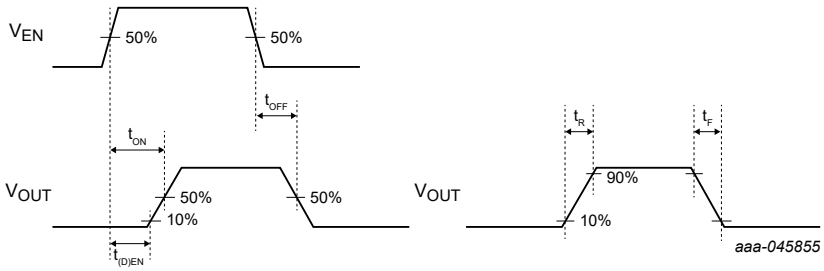
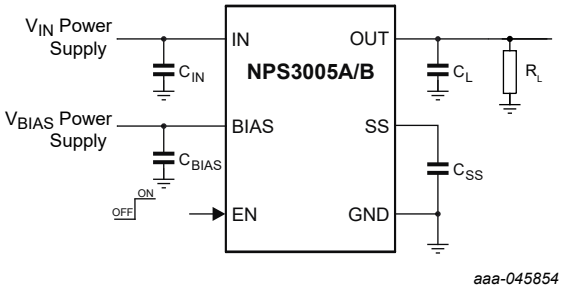


Fig. 5. timing waveforms



EN control signal rise and fall times are 100 ns

Turnoff and fall times depend on the load time constant.

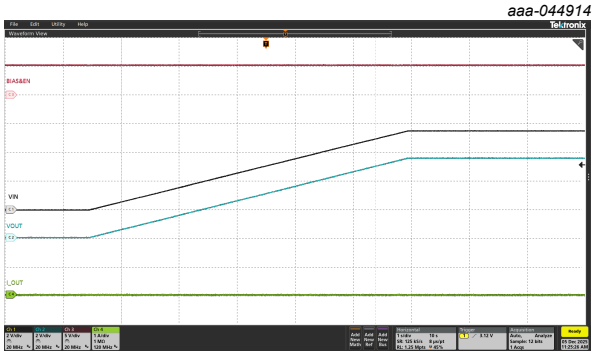
NPS3005A: When the switch is disabled. The time constant is $R_L \times C_L$.

NPS3005B: When the switch is disabled, its internal pull-down resistance R_{PD} is enabled. The time constant $R_{PD}||R_L \times C_L$.

Fig. 6. Test circuit for timing waveforms

15.2. Typical characteristics

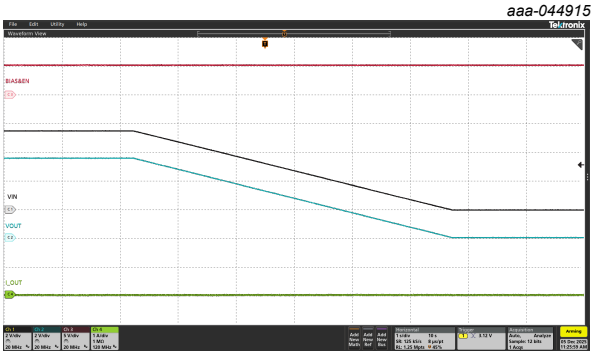
aaa-044914



$V_{BIAS} = V_{IN} = V_{EN}$ = 5.5 V, 0.001 V/ms, I_{Load} = 0 A
T_{amb} = 25, C_{IN} = 1 µF, C_{OUT} = 0.1 µF, C_{SS} = 1 nF

Fig. 7. Turn ON V_{IN}

aaa-044915



$V_{BIAS} = V_{IN} = V_{EN}$ = 5.5 V, 0.001 V/ms, I_{Load} = 0 A
T_{amb} = 25, C_{IN} = 1 µF, C_{OUT} = 0.1 µF, C_{SS} = 1 nF

Fig. 8. Turn OFF V_{IN}

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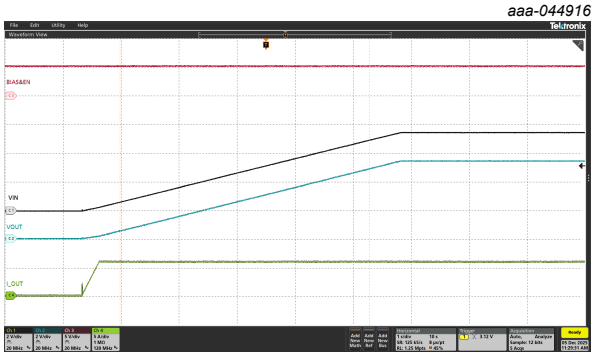

$V_{BIAS} = V_{IN} = V_{EN}$ = 5.5 V, 0.001 V/ms, I_{Load} = 6 A
T_{amb} = 25, C_{IN} = 1 µF, C_{OUT} = 0.1 µF, C_{SS} = 1 nF

Fig. 9. Turn ON V_{IN}

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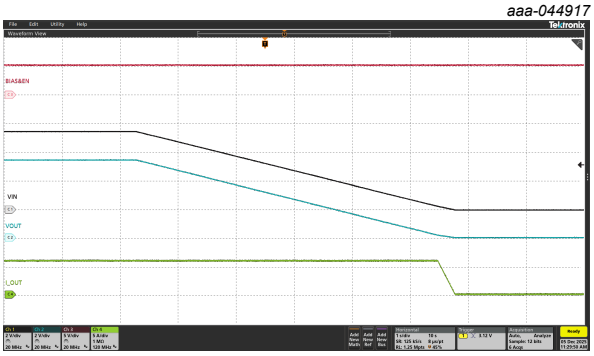

$V_{BIAS} = V_{IN} = V_{EN}$ = 5.5 V, 0.001 V/ms, I_{Load} = 6 A
T_{amb} = 25, C_{IN} = 1 µF, C_{OUT} = 0.1 µF, C_{SS} = 1 nF

Fig. 10. Turn OFF V_{IN}

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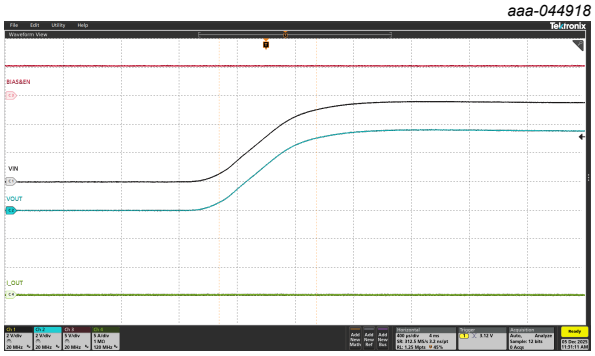
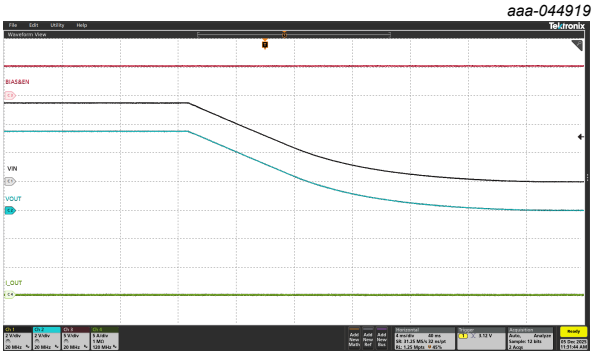


$V_{BIAS} = V_{IN} = V_{EN}$ = 5.5 V, 10 V/ms, I_{Load} = 0 A
T_{amb} = 25, C_{IN} = 1 µF, C_{OUT} = 0.1 µF, C_{SS} = 1 nF

Fig. 11. Turn ON V_{IN}

aaa-044919



$V_{BIAS} = V_{IN} = V_{EN}$ = 5.5 V, 10 V/ms, I_{Load} = 0 A
T_{amb} = 25, C_{IN} = 1 µF, C_{OUT} = 0.1 µF, C_{SS} = 1 nF

Fig. 12. Turn OFF V_{IN}

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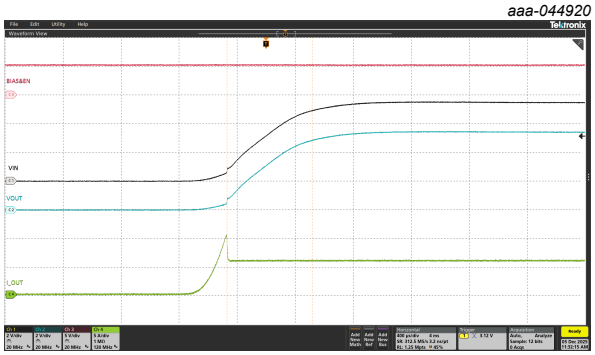
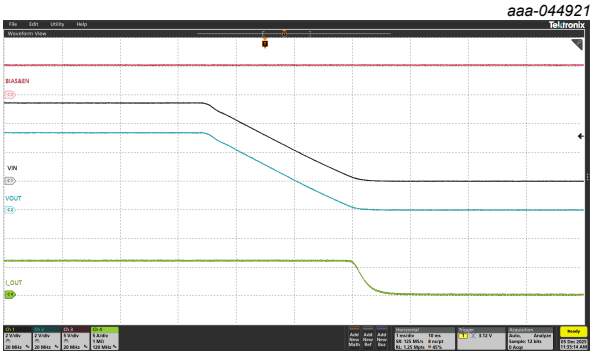


V_{BIAS} = V_{IN} = V_{EN} = 5.5 V, 10 V/ms, I_{Load} = 6 A
T_{amb} = 25, C_{IN} = 1 µF, C_{OUT} = 0.1 µF, C_{SS} = 1 nF

Fig. 13. Turn ON V_{IN}

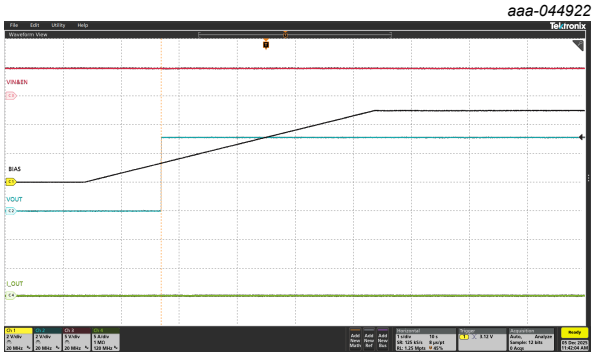
aaa-044921



V_{BIAS} = V_{IN} = V_{EN} = 5.5 V, 10 V/ms, I_{Load} = 6 A
T_{amb} = 25, C_{IN} = 1 µF, C_{OUT} = 0.1 µF, C_{SS} = 1 nF

Fig. 14. Turn OFF V_{IN}

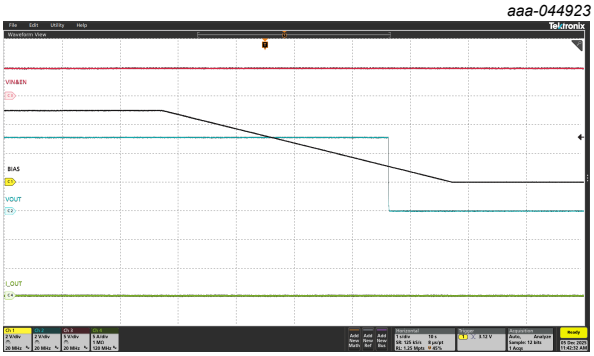
aaa-044922



V_{BIAS} = V_{IN} = V_{EN} = 5 V, 0.001 V/ms, I_{Load} = 0 A
T_{amb} = 25, C_{IN} = 1 µF, C_{OUT} = 0.1 µF, C_{SS} = 1 nF

Fig. 15. Turn ON V_{BIAS}

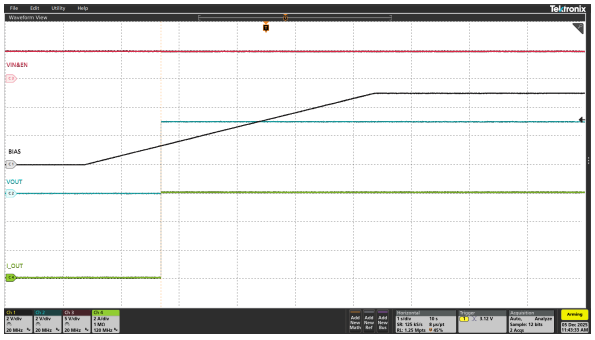
aaa-044923



V_{BIAS} = V_{IN} = V_{EN} = 5 V, 0.001 V/ms, I_{Load} = 0 A
T_{amb} = 25, C_{IN} = 1 µF, C_{OUT} = 0.1 µF, C_{SS} = 1 nF

Fig. 16. Turn OFF V_{BIAS}

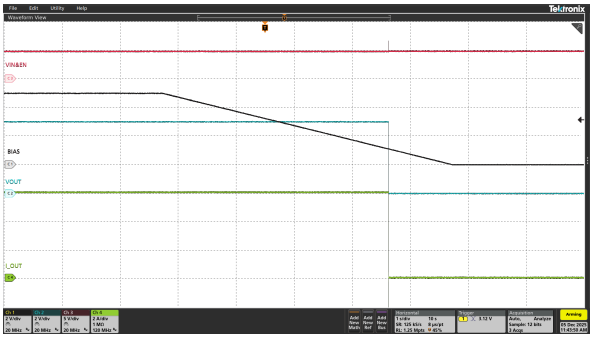
aaa-044924



V_{BIAS} = V_{IN} = V_{EN} = 5 V, 0.001 V/ms, I_{Load} = 6 A
T_{amb} = 25, C_{IN} = 1 µF, C_{OUT} = 0.1 µF, C_{SS} = 1 nF

Fig. 17. Turn ON V_{BIAS}

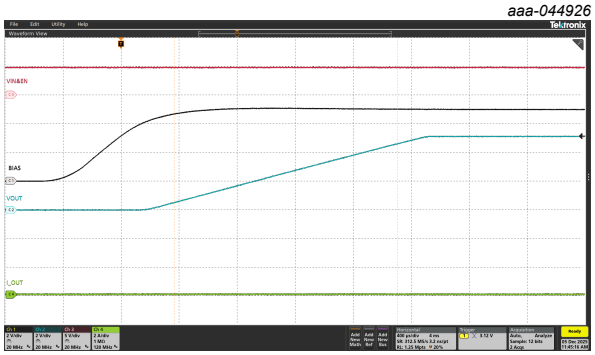
aaa-044925



V_{BIAS} = V_{IN} = V_{EN} = 5 V, 0.001 V/ms, I_{Load} = 6 A
T_{amb} = 25, C_{IN} = 1 µF, C_{OUT} = 0.1 µF, C_{SS} = 1 nF

Fig. 18. Turn OFF V_{BIAS}

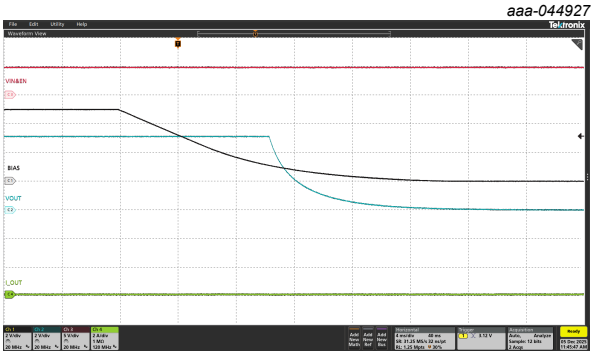
aaa-044926



V_{BIAS} = V_{IN} = V_{EN} = 5 V, 10 V/ms, I_{Load} = 0 A
T_{amb} = 25, C_{IN} = 1 µF, C_{OUT} = 0.1 µF, C_{SS} = 1 nF

Fig. 19. Turn ON V_{BIAS}

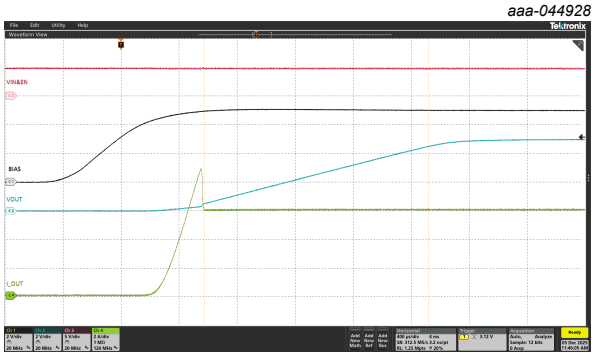
aaa-044927



V_{BIAS} = V_{IN} = V_{EN} = 5 V, 10 V/ms, I_{Load} = 0 A
T_{amb} = 25, C_{IN} = 1 µF, C_{OUT} = 0.1 µF, C_{SS} = 1 nF

Fig. 20. Turn OFF V_{BIAS}

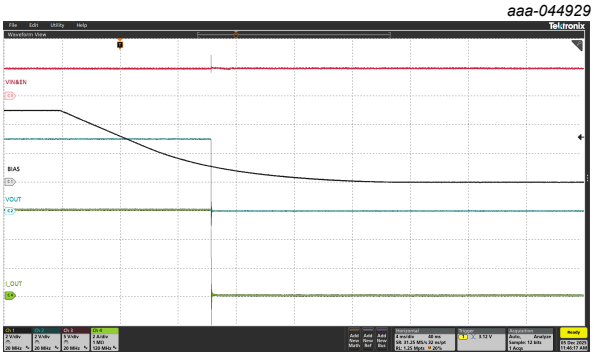
aaa-044928



V_{BIAS} = V_{IN} = V_{EN} = 5 V, 10 V/ms, I_{Load} = 6 A
T_{amb} = 25, C_{IN} = 1 µF, C_{OUT} = 0.1 µF, C_{SS} = 1 nF

Fig. 21. Turn ON V_{BIAS}

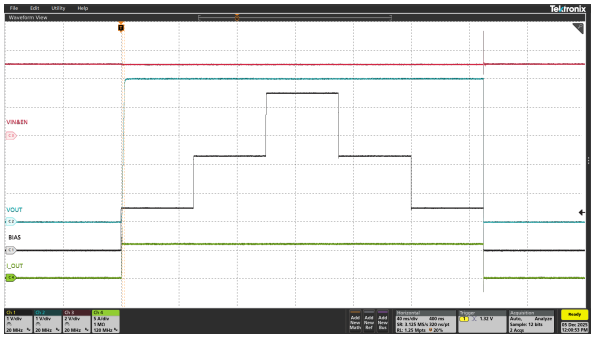
aaa-044929



V_{BIAS} = V_{IN} = V_{EN} = 5 V, 10 V/ms, I_{Load} = 6 A
T_{amb} = 25, C_{IN} = 1 µF, C_{OUT} = 0.1 µF, C_{SS} = 1 nF

Fig. 22. Turn OFF V_{BIAS}

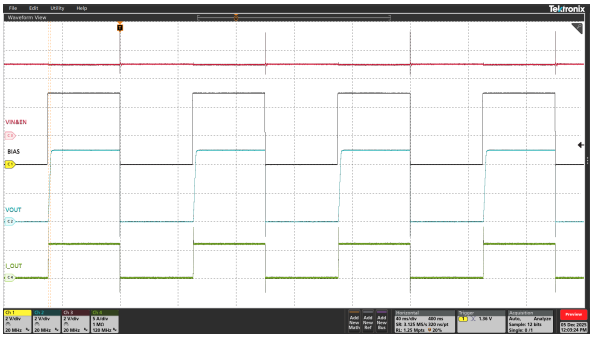
aaa-044930



V_{EN} = V_{IN} = 1.5 V
V_{BIAS}: 0 V>1.5 V>3.3 V>5.5 V>3.3 V>1.5 V>0 V
I_{Load} = 6 A
T_{amb} = 25, C_{IN} = 1 µF, C_{OUT} = 0.1 µF, C_{SS} = 1 nF

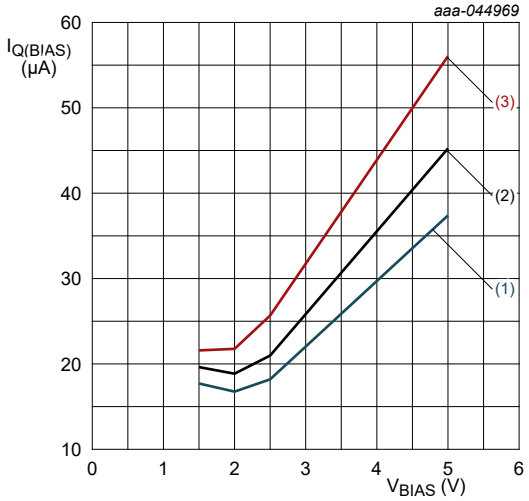
Fig. 23. V_{BIAS} transient

aaa-044931



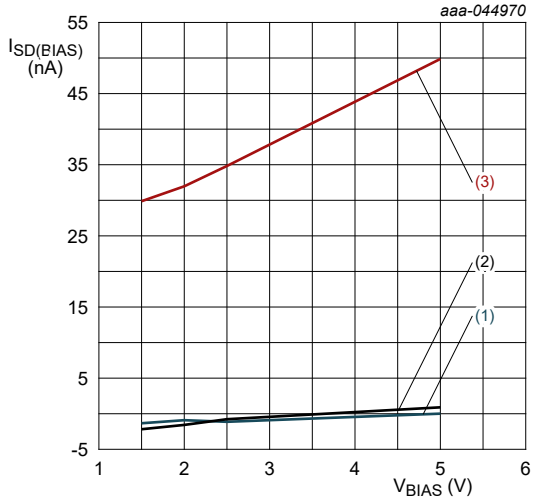
V_{EN} = V_{IN} = 5 V
V_{BIAS} = 5 V, 10 Hz
I_L = 6 A
T_{amb} = 25, C_{IN} = 1 µF, C_{OUT} = 0.1 µF, C_{SS} = 1 nF

Fig. 24. V_{BIAS} toggle



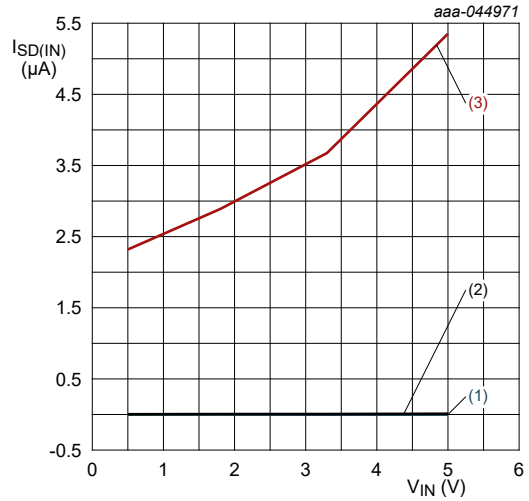
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 125 °C

Fig. 25. BIAS quiescent current vs BIAS voltage



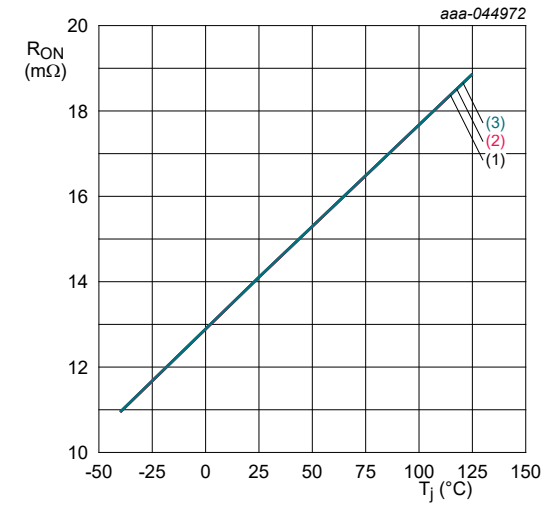
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 125 °C

Fig. 26. BIAS shutdown current vs BIAS voltage



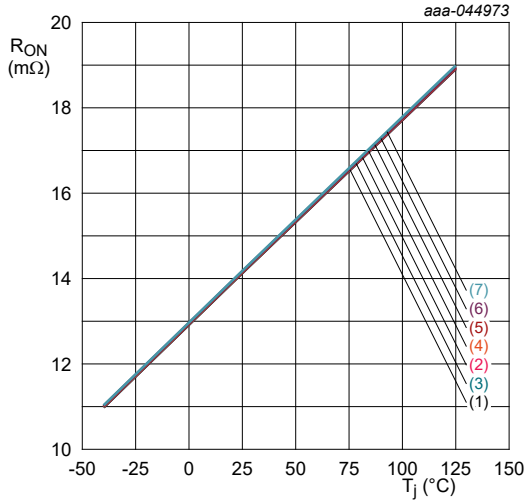
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 125 °C

Fig. 27. VIN OFF-state supply current vs input voltage



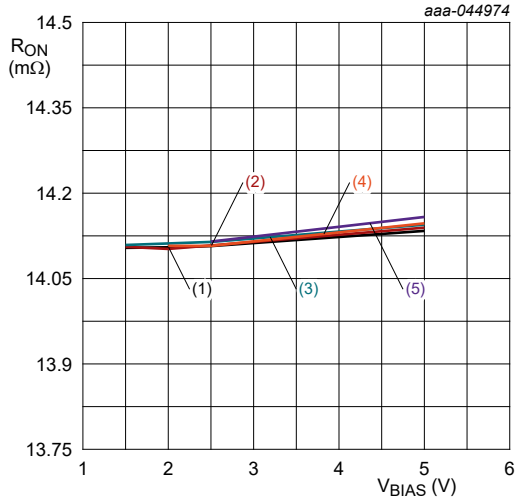
V_{BIAS} = 1.5 V
(1) V_{IN} = 0.5 V
(2) V_{IN} = 1.2 V
(3) V_{IN} = 1.5 V

Fig. 28. ON resistance vs ambient temperature



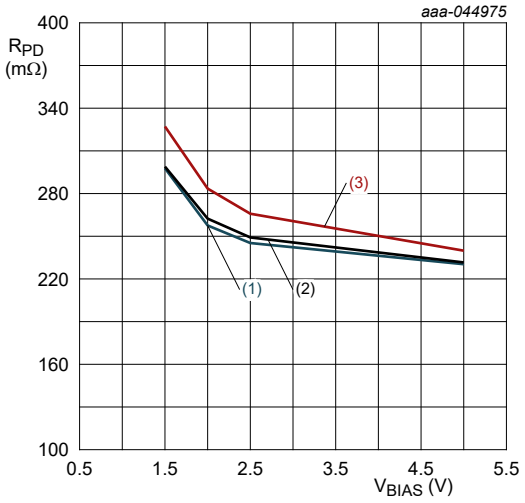
V_{BIAS} = 5 V
(1) V_{IN} = 0.5 V; (2) V_{IN} = 1.2 V
(3) V_{IN} = 1.5 V; (4) V_{IN} = 1.8 V
(5) V_{IN} = 2.5 V; (6) V_{IN} = 3.3 V
(7) V_{IN} = 5 V

Fig. 29. ON resistance vs ambient temperature



(1) V_{IN} = 0.5 V; (2) V_{IN} = 1.2 V
(3) V_{IN} = 1.5 V; (4) V_{IN} = 1.8 V
(5) V_{IN} = 2.5 V; (6) V_{IN} = 3.3 V
(7) V_{IN} = 5 V

Fig. 30. ON resistance vs BIAS voltage



(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 125 °C

Fig. 31. Output pull-down resistance vs BIAS voltage

16. Detailed description

16.1. Overview

The switch is a single-channel, 6A rated load switch that integrates an N-channel MOSFET (NMOS). The device supports an externally configurable soft-start time for applications requiring a controlled rise time on the output voltage (VOUT). When the device is disabled, the OUT pin is driven low on the NPS3005B, whereas it remains floating on the NPS3005A. In addition, the device incorporates thermal shutdown protection to prevent failures caused by excessive temperature.

16.2. Functional diagram

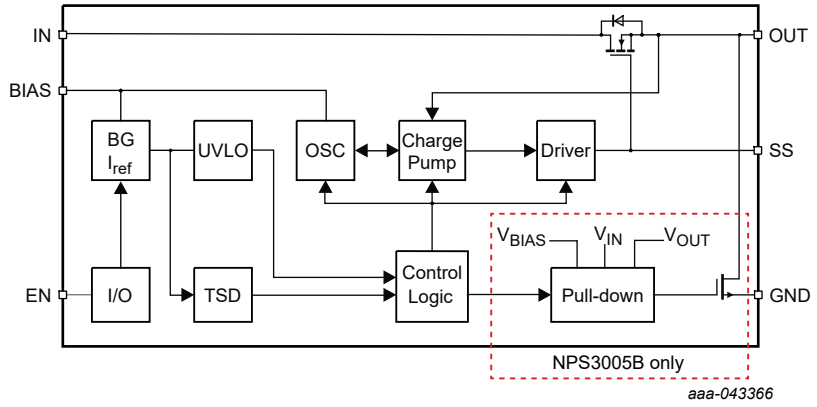


Fig. 32. Functional diagram

16.3. Feature description

Enable (EN)

The logic enable (pin EN) circuit controls the power switch, a logic high (above 1 V) enables the internal MOSFET. The EN input is compatible with both TTL and CMOS logic levels.

Bias voltage range

BIAS input is necessary for the ON resistance to be stable. It provides an external power to the internal charge pump, which supplies stable voltage to the driver of the power MOSFET switch.

It is recommended to apply voltage to the IN pin not larger than the BIAS input voltage. This is necessary to maintain the ON resistance in spec; otherwise, it will be larger.

Adjustable Soft Start

The device provides an externally adjustable soft-start function, which limits inrush current and minimizes voltage drop across the power MOSFET during startup. The soft-start time is configured by placing an external capacitor, C_{SS}, between the SS pin and ground.

The voltage on the SS pin can reach as high as 12V in normal operation. Use a 25 V external C_{SS} capacitor to prevent overvoltage stress and minimize DC bias effects.

Valid for V_{BIAS} = 5 V, C_{IN} = 1 µF, C_{OUT} = 0.1 µF, and T_{amb} = 25 °C, the equation below approximates the 10% to 90% soft start time as a function of C_{SS}:

$$t_R = \left(0.251 \times C_{SS} + 19.1\right) \times V_{IN} + 0.036 \times C_{SS} + 17 \ (\mu s)$$

Where

- C_{SS} is the soft start capacitance (pF).
- VIN is the IN pin supply voltage (V).

See Table 14 for typical rise time, t_R, results.

Quick output discharge (NPS3005B)

An internal 230 Ω pull-down resistor is connected between OUT pin and GND when the NPS3005B is disabled to prevent the OUT pin from being floating.

Functional modes

When the voltages on the IN and BIAS pins are within their recommended operating conditions (Table 8), and the EN pin is high, the power switch is enabled connecting IN to OUT.

When the voltages on the IN and BIAS pins are within their recommended operating conditions (Table 8), and the EN pin is low: the power switch is disabled with:

- NPS3005A: OUT pin floating
- NPS3005B: OUT pin internally connected to GND via internal resistance R_{PD}.

Refer to Table 13.

Table 13. OUT pin connection

EN	NPS3005A	NPS3005B
L	Open	GND via R_{PD}
H	VIN	VIN

17. Application information

The typical application circuit is shown in Fig. 33. Component selection is explained below.

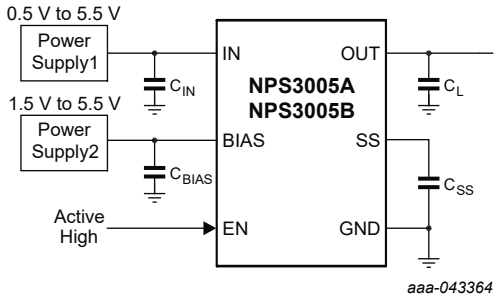
Input Capacitor

It is recommended to place a 1µF (or larger) capacitor close to the IN pins of the load switch. This capacitor mitigates voltage droop resulting from inrush current during startup. For high-current applications, a larger input capacitor may be required to achieve additional reduction in voltage drop. In general, the input capacitor should be sized to approximately ten times the value of the output capacitor.

Output Capacitor

A capacitor of 0.1 µF or a higher value is recommended to be placed between the OUT pins and GND. The switching times are affected by the capacitance. A larger capacitor makes the initial turn-on transient smoother. This capacitor must be large enough to supply a fast transient load to prevent the output from dropping.

Typical Application



V_{IN} = 1.8 V
V_{BIAS} = 5 V
C_{IN} = 1 µF
C_{BIAS} = 1 µF
C_L = 0.1 µF

Fig. 33. Typical application circuit

Soft start

The soft start of the load-switch can be adjusted with external capacitors connected between the SS pin and GND, and the rising time with different capacitors when VBIAS is 5 V is shown in Table 12 (output voltage VOUT rising time measured from 10% to 90% of its final steady state value).

Table 14. Typical values of Rise Time (µs) at 25 °C with a 25 V X7R 10% ceramic capacitor on the SS PIN

Note: *Rising time (µs) of V_{OUT} from 10% to 90%; C_L = 0.1 µF, R_L = 10 Ω, V_{BIAS} = 5 V.*

C_{SS} (pF)	V_{IN} = 5 V	V_{IN} = 3.3 V	V_{IN} = 1.8 V	V_{IN} = 1.5 V	V_{IN} = 1.2 V	V_{IN} = 1.05 V	V_{IN} = 0.8 V	V_{IN} = 0.5 V
0	114	84	56	50	44	41	36	28
220	397	273	162	140	118	107	87	65
470	720	489	285	244	202	182	147	105
1000	1460	985	565	480	396	354	283	199
2200	3184	2122	1188	1006	822	730	579	400
4700	6287	4212	2383	2020	1649	1470	1166	804
10000	13000	8719	4935	4177	3410	3022	2393	1644

18. Layout

Power supply recommendations

The load-switch is designed to operate with a V_{IN} range of 0.5 V to 5.5 V, V_{BIAS} range of 1.5 V to 5.5 V. The V_{IN} and V_{BIAS} power supply must be well regulated and placed as close to the device terminal as possible. The power supply must be able to withstand all transient load current steps. In most situations, using an input capacitance (C_{IN}) of 1 µF is sufficient to prevent the supply voltage from dropping when the switch is turned on. In cases where the power supply is slow to respond to a large transient current or large load current step, additional bulk capacitance may be required on the input.

Layout guidelines

For best performance, all traces must be as short as possible. To be most effective, the input and output capacitors must be placed close to the device to minimize the effects that parasitic trace inductances may have on normal operation. Using wide traces for V_{IN}, V_{OUT}, and GND helps minimize the parasitic electrical effects.

Layout example

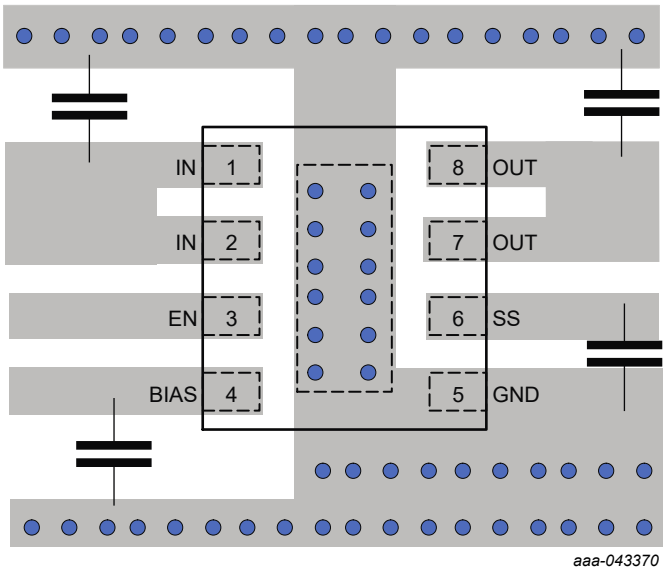


Fig. 34. Layout example

19. Thermal considerations

The maximum IC junction temperature should be restricted to 150 °C under normal operating conditions. To calculate the maximum allowable dissipation, $P_{D(max)}$ for a given output current and ambient temperature, the equation as shown below can be used:

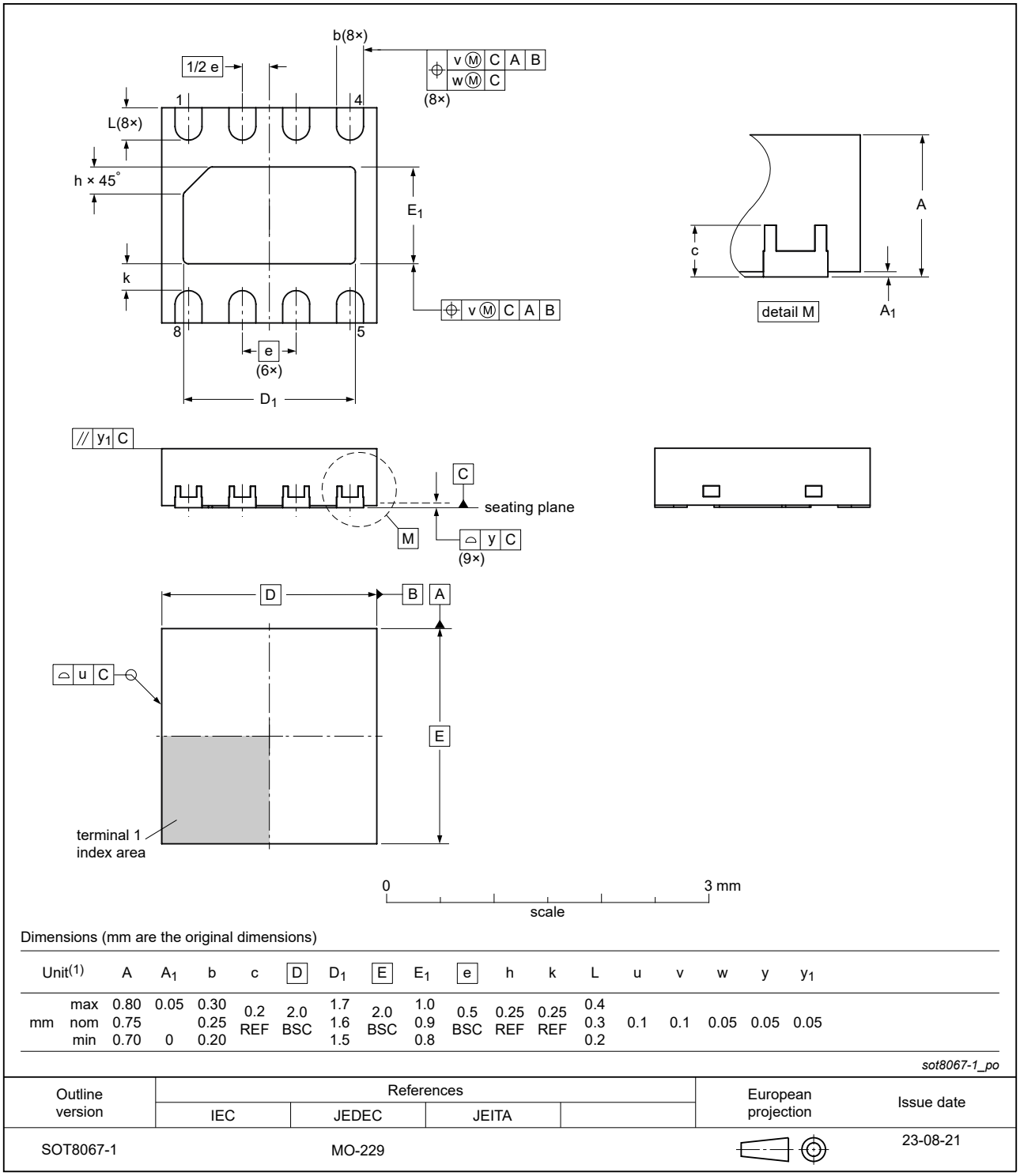
$$P_{D(MAX)} = \frac{T_{j(MAX)} - T_{amb}}{\theta_{JA}}$$

Where:

$P_{D(MAX)}$ = maximum allowable power dissipation
$T_{j(MAX)}$ = maximum allowable junction temperature (150 °C for the NPA3005A/NPS3005B devices)
T_{amb} = ambient temperature of the device
θ_{JA} = junction to air thermal impedance. This parameter is highly dependent upon board layout.

20. Package outline

HWSON8: plastic thermal enhanced very very thin Small Outline packages, no leads; 8 terminals; 0.5 mm pitch; 2.0 mm x 2.0 mm x 0.75 mm body **SOT8067-1**



Dimensions (mm are the original dimensions)

Unit[1]		A	A_1	b	c	D	D_1	E	E_1	e	h	k	L	u	v	w	y	y_1
mm	max	0.80	0.05	0.30	0.2	2.0	1.7	2.0	1.0	0.5	0.25	0.25	0.4	0.1	0.1	0.05	0.05	0.05
	nom	0.75		0.25	REF	BSC	1.6	BSC	0.9	BSC	REF	REF	0.3					
	min	0.70	0	0.20			1.5		0.8				0.2					

sot8067-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT8067-1		MO-229				23-08-21

Fig. 35. Package outline SOT8067-1 (HWSON8)

21. Abbreviations

Table 15. Abbreviations

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
TTL	Transistor-Transistor Logic
HBM	Human Body Model
ESD	ElectroStatic Discharge

22. Revision history

Table 16. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
NPS3005A_B v.1	20260617	Product data sheet	-	-

23. Legal information

Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at https://www.nexperia.com.

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