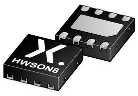


# NPS3005

## 0.5 V to 5.5 V, 6 A, 15 mΩ, single channel load switch with soft start

**Rev. 1.1 — 10 June 2025** **Product data sheet**

## 1. General description

NPS3005 is a single channel load switch with an adjustable soft start. It contains a 6 A continuous current rated N-channel MOSFET that can operate over an input voltage range of 0.5 V to 5.5 V.

NPS3005 is controlled by an EN pin which supports down to 1.2 V control voltage.

NPS3005 provides stable On-resistance with an extra BIAS pin operating from 1.5 V to 5.5 V.

NPS3005 integrates over temperature protection. The internal MOSFET will be turned off when the junction temperature exceeds 160 ºC and will be turned on automatically when the junction temperature drops by 20 ºC.

NPS3005 integrates an 230 Ω on-chip resistor between output and ground pin for Quick Output Discharge (QOD) when the switch is turned off.

The NPS3005 is offered 8 pin 2 mm x 2 mm HWSON8 package with thermal pad for better thermal conductivity. this product family is characterized for operation over a -40 ºC to +105 ºC ambient temperature range.

## 2. Features and benefits

- 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
- 15 mΩ (typical) on-resistance
- 1.2 V control logic compatible
- Adjustable soft start
- Quick output discharge
- Thermal shutdown
- ESD protection:
  - HBM ANSI/ESDA/JEDEC JS-001 exceeds 2000 V
  - CDM ANSI/ESDA/JEDEC JS-002 exceeds 1000 V
- SOT8067-1 (HWSON8) with thermal pad (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)
- Specified from -40 °C to +105 °C

## 3. Applications

- Solid State Drive (SSD)
- Notebooks and Netbooks
- Tablet PC
- Telecom/Networking/Datacom
- Set-top box
- Optical Module
- Consumer Electronic

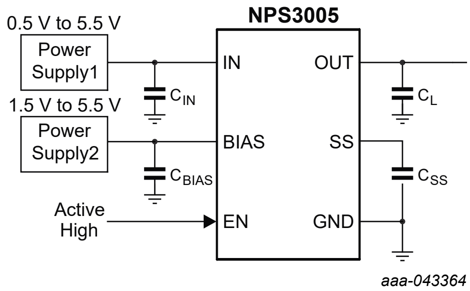



**Fig. 1. Typical application circuit**

# 4. Ordering information

**Table 1. Ordering information**

| Type number | Package | | | |
|---|---|---|---|---|
| | Temperature range | Name | Description | Version |
| NPS3005GP | -40 °C to +105 °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 |

# 5. Marking

**Table 2. Marking**

| Type number | Marking code |
|---|---|
| NPS3005GP | s35 |

# 6. Selection guide

**Table 3. Selection guide**

| Type number | Enable | $R_{ON}$ | $I_{MAX}$ | QOD |
|---|---|---|---|---|
| NPS3005GP | Active high | 15 mΩ | 6 A | YES |

# 7. Functional diagram

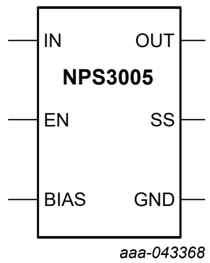



**Fig. 2. Logic symbol**

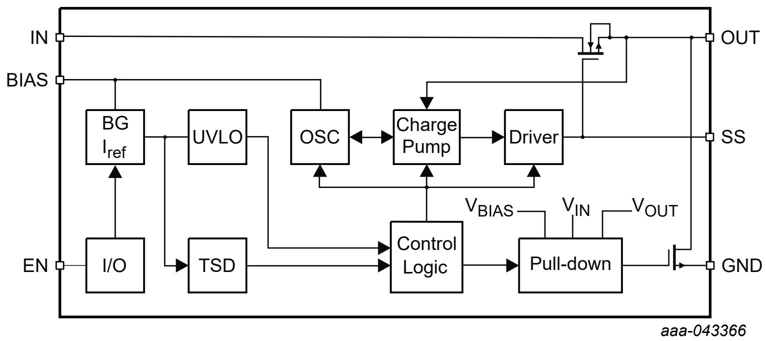
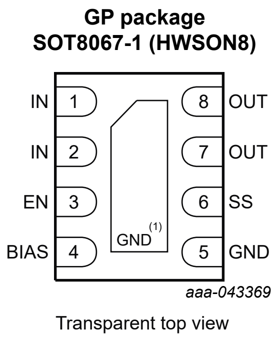



**Fig. 3. Functional diagram**

# 8. Pinning information

## 8.1. Pinning




(1) This is not a ground pin, the thermal pad (exposed center pad) should be connected to GND.

**Fig. 4. Pin configuration SOT8067-1 (HWSON8)**

## 8.2. Pin description

**Table 4. 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 | Enable input of switch. Active High to enable NPS3005. 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 | Connect Thermal PAD to ground externally to have better thermal performance. |

## 9. Limiting values

**Table 5. 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 | | - | 6 | 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 6. ESD ratings**

| Symbol | Parameter | Conditions | Value | Unit |
|---|---|---|---|---|
| $V_{ESD}$ | electrostatic discharge voltage | HBM: ANSI/ESDA/JEDEC JS-001 class 2 | ±2000 | V |
| | | CDM: ANSI/ESDA/JEDEC JS-002 class C3 | ±1000 | V |

## 11. Recommended operating conditions

**Table 7. Recommended operating conditions**

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{IN}$ | input voltage | | 0.5 | $V_{BIAS}$ | 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 | 1 | 5.5 | V |
| $V_{IL}$ | LOW level input voltage | EN pin | 0 | 0.4 | V |
| $T_{amb}$ | ambient temperature | | –40 | 105 | °C |

## 12. Recommended components

**Table 8. 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. Static characteristics

**Table 9. 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 +105 °C | - | 37 | 45 | µA |
| $I_{SD(BIAS)}$ | shutdown current | BIAS pin; $V_{EN}$ = $V_{OUT}$ = 0 V | –40 °C to +105 °C | - | 0.5 | 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 +85 °C | - | 0.87 | 6.9 | µA |
| | | | –40 °C to +105 °C | - | 7.3 | 22 | µA |
| | | $V_{IN}$ = 3.3 V | –40 °C to +85 °C | - | 0.6 | 4.5 | µA |
| | | | –40 °C to +105 °C | - | 5.2 | 15 | µA |
| | | $V_{IN}$ = 1.8 V | –40 °C to +85 °C | - | 0.44 | 2.5 | µA |
| | | | –40 °C to +105 °C | - | 4.2 | 8.5 | µA |
| | | $V_{IN}$ = 0.5 V | –40 °C to +85 °C | - | 0.33 | 2 | µA |
| | | | –40 °C to +105 °C | - | 3.3 | 7 | µA |
| $I_{EN}$ | input leakage current | EN pin; $V_{EN}$ = 5.5 V | –40 °C to +105 °C | - | - | 0.1 | µA |
| $V_{EN(hys)}$ | input hysteresis voltage | EN pin; $V_{IN}$ = 5 V | 25 °C | - | 120 | - | mV |
| $R_{PD}$ | output pull-down resistance | $V_{IN}$ = 5 V, $V_{EN}$ = 0 V | –40 °C to +105 °C | - | 230 | 320 | Ω |
| $T_{SD}$ | thermal shutdown | junction temperature rising | - | - | 160 | - | °C |
| $T_{SD(hys)}$ | thermal shutdown hysteresis | junction temperature falling | - | - | 20 | - | °C |

| Symbol | Parameter | Conditions | $T_{amb}$ | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **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 | 25 °C | - | 18 | 27 | μA |
| | | | –40 °C to +105 °C | - | 23 | 32 | μA |
| $I_{SD(BIAS)}$ | shutdown current | BIAS pin; $V_{EN}$ = $V_{OUT}$ = 0 V | 25 °C | - | 0.2 | 0.6 | μA |
| | | | –40 °C to +105 °C | | 0.3 | 1 | μA |
| $I_{SD(IN)}$ | off-state supply current | IN pin; $V_{EN}$ = $V_{OUT}$ = 0 V | | | | | |
| | | $V_{IN}$ = 2.5 V | –40 °C to +85 °C | - | 0.51 | 2.9 | μA |
| | | | –40 °C to +105 °C | - | 4.6 | 9.5 | μA |
| | | $V_{IN}$ = 1.8 V | –40 °C to +85 °C | - | 0.44 | 2.5 | μA |
| | | | –40 °C to +105 °C | - | 4.2 | 8.5 | μA |
| | | $V_{IN}$ = 0.5 V | –40 °C to +85 °C | - | 0.33 | 2 | μA |
| | | | –40 °C to +105 °C | - | 3.2 | 7 | μA |
| $I_{EN}$ | input leakage current | EN pin; $V_{EN}$ = 5.5 V | –40 °C to +105 °C | - | - | 0.1 | μA |
| $V_{EN(hys)}$ | input hysteresis voltage | EN pin; $V_{IN}$ = 2.5 V | 25 °C | - | 85 | - | mV |
| $R_{PD}$ | output pull-down resistance | $V_{IN}$ = 2.5 V, $V_{EN}$ = 0 V | –40 °C to +105 °C | - | 230 | 340 | Ω |
| $T_{SD}$ | thermal shutdown | junction temperature rising | - | - | 160 | - | °C |
| $T_{SD(hys)}$ | thermal shutdown hysteresis | junction temperature falling | - | - | 20 | - | °C |

| Symbol | Parameter | Conditions | $T_{amb}$ | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Power supply and current, $V_{BIAS}$ = 2 V** | | | | | | | |
| $I_{Q(BIAS)}$ | quiescent current | BIAS pin; no load; $V_{IN}$ = $V_{EN}$ = 2 V | 25 °C | - | 18 | 25 | µA |
| | | | –40 °C to +105 °C | - | 22 | 30 | µA |
| $I_{SD(BIAS)}$ | shutdown current | BIAS pin; $V_{EN}$ = $V_{OUT}$ = 0 V | 25 °C | - | 0.2 | 0.6 | µA |
| | | | –40 °C to +105 °C | - | 0.3 | 1 | µA |
| $I_{SD(IN)}$ | off-state supply current | IN pin; $V_{EN}$ = $V_{OUT}$ = 0 V | | | | | |
| | | $V_{IN}$ = 2 V | –40 °C to +85 °C | - | 0.46 | 2.8 | µA |
| | | | –40 °C to +105 °C | - | 4.3 | 9.5 | µA |
| | | $V_{IN}$ = 1.8 V | –40 °C to +85 °C | - | 0.44 | 2.5 | µA |
| | | | –40 °C to +105 °C | - | 4.2 | 8.5 | µA |
| | | $V_{IN}$ = 1.2 V | –40 °C to +85 °C | - | 0.39 | 2.3 | µA |
| | | | –40 °C to +105 °C | - | 3.8 | 8 | µA |
| | | $V_{IN}$ = 0.5 V | –40 °C to +85 °C | - | 0.33 | 2 | µA |
| | | | –40 °C to +105 °C | - | 3.3 | 7 | µA |
| $I_{EN}$ | input leakage current | EN pin; $V_{EN}$ = 5.5 V | –40 °C to +105 °C | - | - | 0.1 | µA |
| $V_{EN(hys)}$ | input hysteresis voltage | EN pin; $V_{IN}$ = 2 V | 25 °C | - | 80 | - | 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 falling | - | - | 20 | - | °C |
| **Power supply and current, $V_{BIAS}$ = 1.5 V** | | | | | | | |
| $I_{Q(BIAS)}$ | quiescent current | BIAS pin; no load; $V_{IN}$ = $V_{EN}$ = 1.5 V | 25 °C | - | 57 | 70 | µA |
| | | | –40 °C to +105 °C | - | 70 | 85 | µA |
| $I_{SD(BIAS)}$ | shutdown current | BIAS pin; $V_{EN}$ = $V_{OUT}$ = 0 V | 25 °C | - | 0.15 | 0.5 | µA |
| | | | –40 °C to +105 °C | - | 0.2 | 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 +85 °C | - | 0.42 | 2.5 | µA |
| | | | –40 °C to +105 °C | - | 4 | 8.5 | µA |
| | | $V_{IN}$ = 0.5 V | –40 °C to +85 °C | - | 0.33 | 2 | µA |
| | | | –40 °C to +105 °C | - | 3.3 | 7 | µA |
| $I_{EN}$ | input leakage current | EN pin; $V_{EN}$ = 5.5 V | –40 °C to +105 °C | - | - | 0.1 | µA |
| $V_{EN(hys)}$ | input hysteresis voltage | EN pin; $V_{IN}$ = 1.5 V | 25 °C | - | 70 | - | 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 |
| $T_{SD(hys)}$ | thermal shutdown hysteresis | junction temperature falling | - | - | 20 | - | °C |

| Symbol | Parameter | Conditions | $T_{amb}$ | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **ON resistance ($R_{ON}$), $V_{BIAS}$ = 5 V** | | | | | | | |
| $R_{ON}$ | ON resistance | $I_{OUT}$ = –200 mA, $V_{BIAS}$ = 5 V | | | | | |
| | | $V_{IN}$ = 5 V | 25 °C | - | 15 | 19 | mΩ |
| | | | –40 °C to +85 °C | - | - | 23 | mΩ |
| | | | –40 °C to +105 °C | - | - | 25 | mΩ |
| | | $V_{IN}$ = 3.3 V | 25 °C | - | 15 | 19 | mΩ |
| | | | –40 °C to +85 °C | - | - | 23 | mΩ |
| | | | –40 °C to +105 °C | - | - | 25 | mΩ |
| | | $V_{IN}$ = 2.5 V | 25 °C | - | 15 | 19 | mΩ |
| | | | –40 °C to +85 °C | - | - | 23 | mΩ |
| | | | –40 °C to +105 °C | - | - | 25 | mΩ |
| | | $V_{IN}$ = 1.8 V | 25 °C | - | 15 | 19 | mΩ |
| | | | –40 °C to +85 °C | - | - | 23 | mΩ |
| | | | –40 °C to +105 °C | - | - | 25 | mΩ |
| | | $V_{IN}$ = 1.5 V | 25 °C | - | 15 | 19 | mΩ |
| | | | –40 °C to +85 °C | - | - | 23 | mΩ |
| | | | –40 °C to +105 °C | - | - | 25 | mΩ |
| | | $V_{IN}$ = 1.2 V | 25 °C | - | 15 | 19 | mΩ |
| | | | –40 °C to +85 °C | - | - | 23 | mΩ |
| | | | –40 °C to +105 °C | - | - | 25 | mΩ |
| | | $V_{IN}$ = 0.5 V | 25 °C | - | 15 | 19 | mΩ |
| | | | –40 °C to +85 °C | - | - | 23 | mΩ |
| | | | –40 °C to +105 °C | - | - | 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 | 25 °C | - | 20 | 26 | mΩ |
| | | | –40 °C to +85 °C | - | - | 32 | mΩ |
| | | | –40 °C to +105 °C | - | - | 34 | mΩ |
| | | $V_{IN}$ = 1.8 V | 25 °C | - | 18 | 23 | mΩ |
| | | | –40 °C to +85 °C | - | - | 29 | mΩ |
| | | | –40 °C to +105 °C | - | - | 31 | mΩ |
| | | $V_{IN}$ = 1.5 V | 25 °C | - | 18 | 22 | mΩ |
| | | | –40 °C to +85 °C | - | - | 28 | mΩ |
| | | | –40 °C to +105 °C | - | - | 30 | mΩ |
| | | $V_{IN}$ = 1.2 V | 25 °C | - | 18 | 22 | mΩ |
| | | | –40 °C to +85 °C | - | - | 27 | mΩ |
| | | | –40 °C to +105 °C | - | - | 29 | mΩ |
| | | $V_{IN}$ = 0.5 V | 25 °C | - | 17 | 21 | mΩ |
| | | | –40 °C to +85 °C | - | - | 26 | mΩ |
| | | | –40 °C to +105 °C | - | - | 27 | mΩ |

| Symbol | Parameter | Conditions | $T_{amb}$ | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **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 | 25 °C | - | 20 | - | mΩ |
| | | | –40 °C to +85 °C | - | - | - | mΩ |
| | | | –40 °C to +105 °C | - | - | 35 | mΩ |
| | | $V_{IN}$ = 1.2 V | 25 °C | - | 20 | - | mΩ |
| | | | –40 °C to +85 °C | - | - | - | mΩ |
| | | | –40 °C to +105 °C | - | - | 35 | mΩ |
| | | $V_{IN}$ = 0.5 V | 25 °C | - | 20 | - | mΩ |
| | | | –40 °C to +85 °C | - | - | - | mΩ |
| | | | –40 °C to +105 °C | - | - | 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 | 25 °C | - | 22 | - | mΩ |
| | | | –40 °C to +85 °C | - | - | - | mΩ |
| | | | –40 °C to +105 °C | - | - | 36 | mΩ |
| | | $V_{IN}$ = 1.2 V | 25 °C | - | 22 | - | mΩ |
| | | | –40 °C to +85 °C | - | - | - | mΩ |
| | | | –40 °C to +105 °C | - | - | 36 | mΩ |
| | | $V_{IN}$ = 0.5 V | 25 °C | - | 22 | - | mΩ |
| | | | –40 °C to +85 °C | - | - | - | mΩ |
| | | | –40 °C to +105 °C | - | - | 36 | mΩ |

## 14. Dynamic characteristics

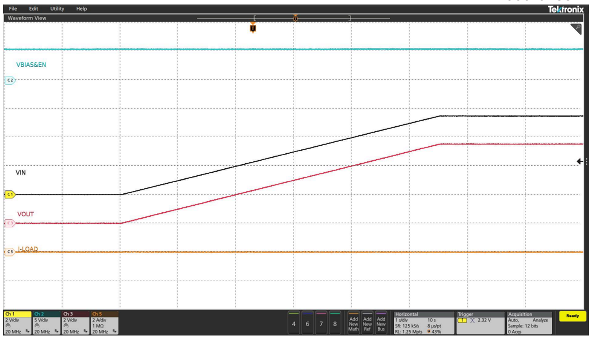
**Table 10. Dynamic characteristics**

*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 | - | 1450 | - | µs |
| | | $V_{IN}$ = $V_{BIAS}$ = 2.5 | - | 2180 | - | 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 | - | 2 | - | µs |
| | | $V_{IN}$ = $V_{BIAS}$ = 2.5 | - | 2 | - | µs |
| $t_R$ | output rise time | $R_L$ = 10 Ω, $C_L$ = 0.1 µF, $C_{IN}$ = 1 µF, $C_{SS}$ = 1 nF, $V_{EN}$ = 5 V, 50% $V_{EN}$ to 50% $V_{OUT}$ | | | | |
| | | $V_{BIAS}$ = 5 V, $V_{IN}$ = 1.5 V | - | 595 | - | µs |
| | | $V_{BIAS}$ = 5 V, $V_{IN}$ = 1.8 V | - | 700 | - | µs |
| | | $V_{BIAS}$ = 5 V, $V_{IN}$ = 3.3 V | - | 1190 | - | µs |
| | | $V_{BIAS}$ = 5 V, $V_{IN}$ = 5 V | - | 1750 | - | µs |
| | | $V_{BIAS}$ = 2.5 V, $V_{IN}$ = 2.5 V | - | 2150 | - | 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, 50% $V_{EN}$ to 50% $V_{OUT}$ | | | | |
| | | $V_{BIAS}$ = 5 V, $V_{IN}$ = 5 V | - | 2 | - | µs |
| | | $V_{BIAS}$ = 2.5 V, $V_{IN}$ = 2.5 V | - | 2 | - | µs |

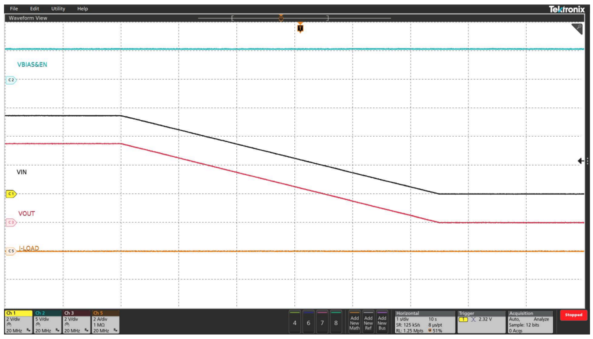
| Symbol | Parameter | Conditions | $T_{amb}$ = 25 °C | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| $t_{D(EN)}$ | EN delay time | $R_L$ = 10 Ω, $C_L$ = 0.1 µF, $C_{IN}$ = 1 µF, $C_{SS}$ = 1 nF, $V_{EN}$ = 5 V, 50% $V_{EN}$ to 50% $V_{OUT}$ | | | | |
| | | $V_{BIAS}$ = 5 V, $V_{IN}$ = 5 V | - | 600 | - | µs |
| | | $V_{BIAS}$ = 2.5 V, $V_{IN}$ = 2.5 V | - | 1120 | - | µs |

## 14.1. Typical characteristics



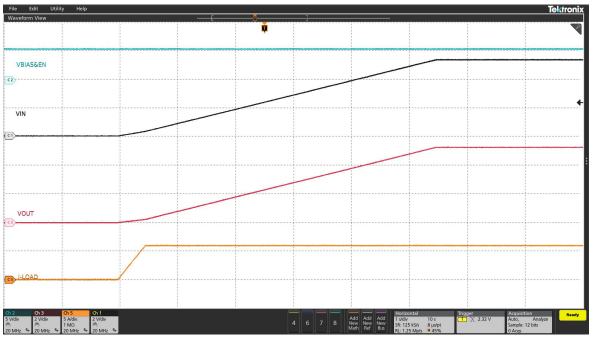

$V_{BIAS}$ = $V_{IN}$ = $V_{EN}$ = 5.5 V, 0.001 V/ms, $I_{Load}$ = 0 A

**Fig. 5. Turn ON $V_{IN}$**



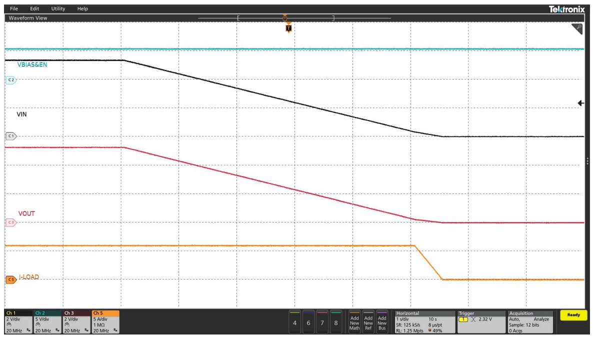

$V_{BIAS}$ = $V_{IN}$ = $V_{EN}$ = 5.5 V, 0.001 V/ms, $I_{Load}$ = 0 A

**Fig. 6. Turn OFF $V_{IN}$**



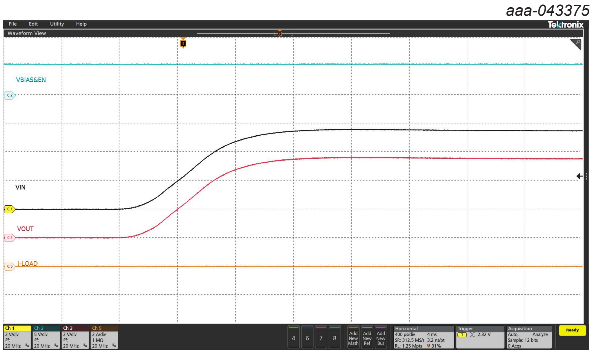

$V_{BIAS}$ = $V_{IN}$ = $V_{EN}$ = 5.5 V, 0.001 V/ms, $I_{Load}$ = 6 A

**Fig. 7. Turn ON $V_{IN}$**



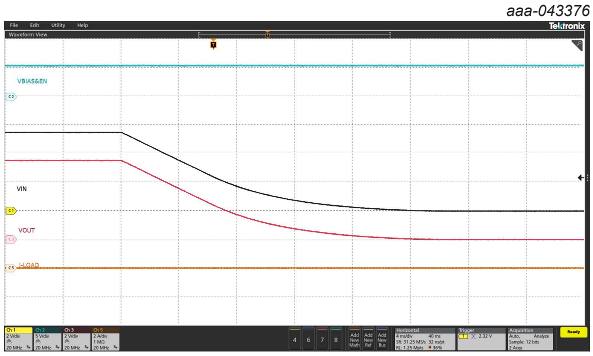

$V_{BIAS}$ = $V_{IN}$ = $V_{EN}$ = 5.5 V, 0.001 V/ms, $I_{Load}$ = 6 A

**Fig. 8. Turn OFF $V_{IN}$**




$V_{BIAS}$ = $V_{IN}$ = $V_{EN}$ = 5.5 V, 10 V/ms, $I_{Load}$ = 0 A

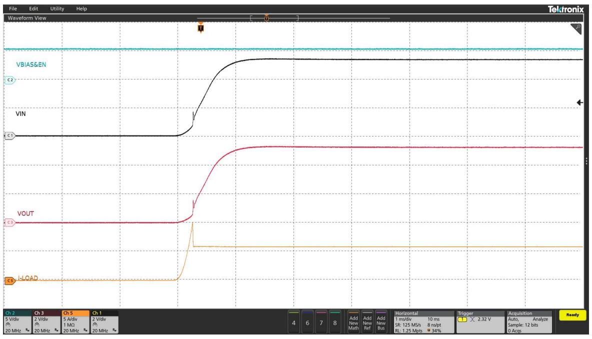
**Fig. 9. Turn ON $V_{IN}$**




$V_{BIAS}$ = $V_{IN}$ = $V_{EN}$ = 5.5 V, 10 V/ms, $I_{Load}$ = 0 A

**Fig. 10. Turn OFF $V_{IN}$**

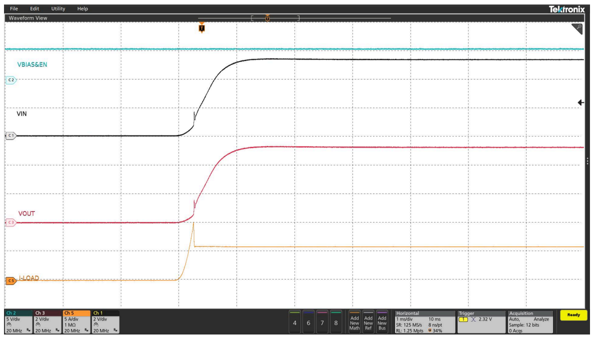
aaa-043377




$V_{BIAS}$ = $V_{IN}$ = $V_{EN}$ = 5.5 V, 10 V/ms, $I_{Load}$ = 6 A

**Fig. 11. Turn ON $V_{IN}$**

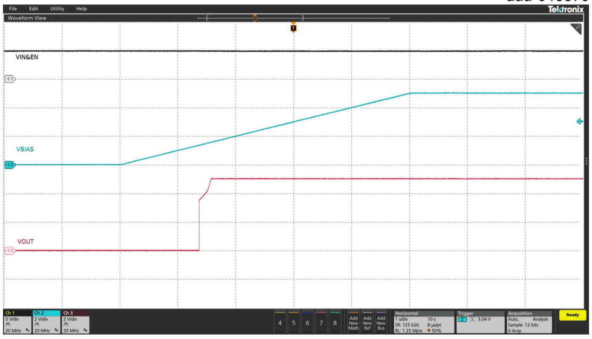
aaa-043378




$V_{BIAS}$ = $V_{IN}$ = $V_{EN}$ = 5.5 V, 10 V/ms, $I_{Load}$ = 6 A

**Fig. 12. Turn OFF $V_{IN}$**

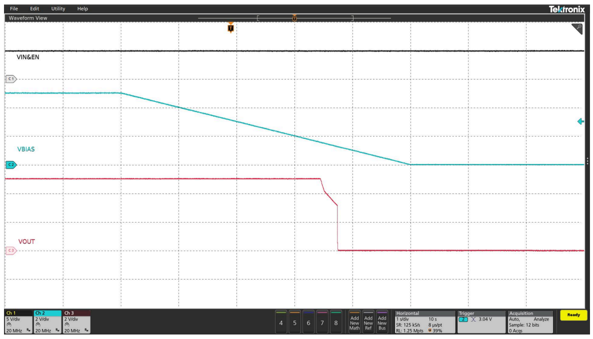
aaa-043379




$V_{BIAS}$ = $V_{IN}$ = $V_{EN}$ = 5 V, 0.001 V/ms, $I_{Load}$ = 0 A

**Fig. 13. Turn ON $V_{BIAS}$**

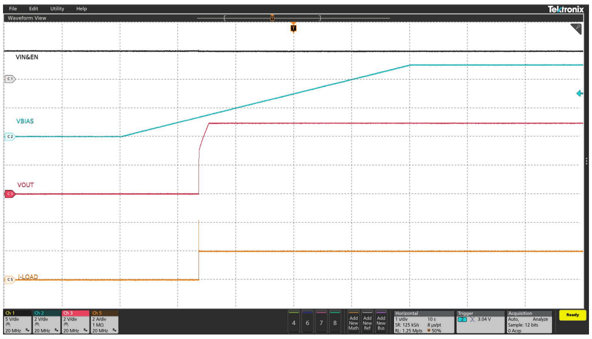
aaa-043380




$V_{BIAS}$ = $V_{IN}$ = $V_{EN}$ = 5 V, 0.001 V/ms, $I_{Load}$ = 0 A

**Fig. 14. Turn OFF $V_{BIAS}$**

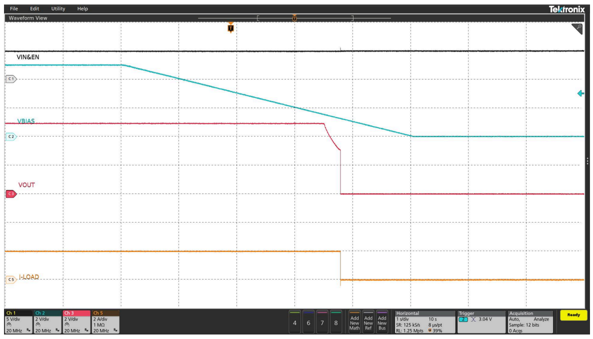
aaa-043381




$V_{BIAS}$ = $V_{IN}$ = $V_{EN}$ = 5 V, 0.001 V/ms, $I_{Load}$ = 2 A

**Fig. 15. Turn ON $V_{BIAS}$**

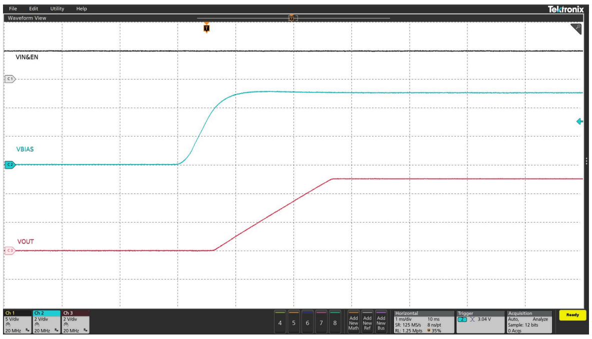
aaa-043382




$V_{BIAS}$ = $V_{IN}$ = $V_{EN}$ = 5 V, 0.001 V/ms, $I_{Load}$ = 2 A

**Fig. 16. Turn OFF $V_{BIAS}$**

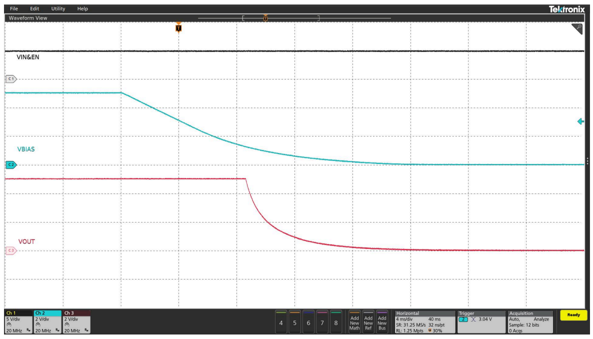
aaa-043383




$V_{BIAS}$ = $V_{IN}$ = $V_{EN}$ = 5 V, 10 V/ms, $I_{Load}$ = 0 A

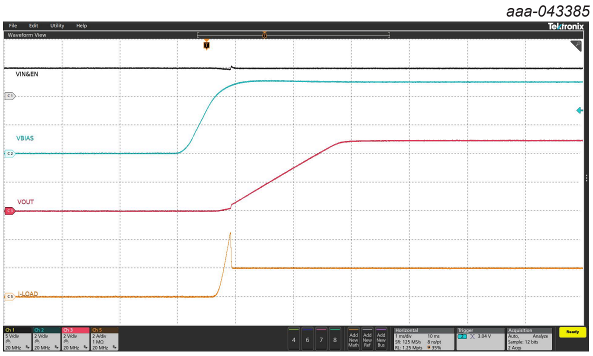
**Fig. 17. Turn ON $V_{BIAS}$**

aaa-043384



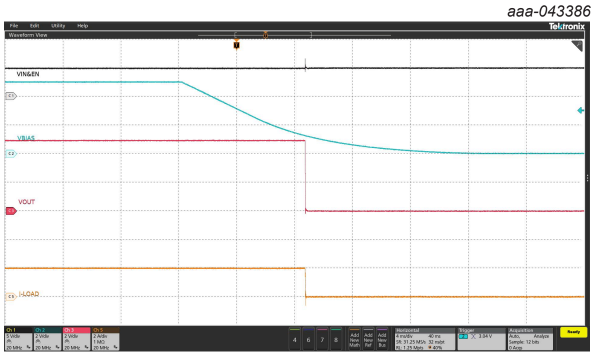

$V_{BIAS}$ = $V_{IN}$ = $V_{EN}$ = 5 V, 10 V/ms, $I_{Load}$ = 0 A

**Fig. 18. Turn OFF $V_{BIAS}$**



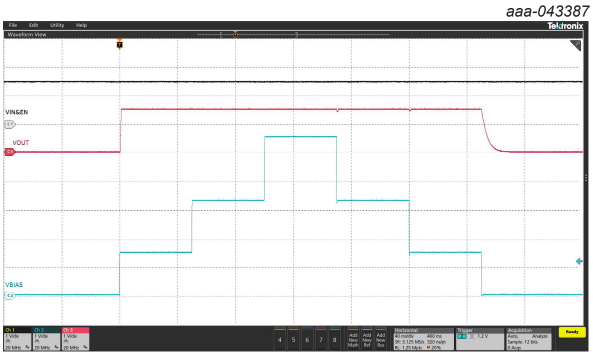

$V_{BIAS} = V_{IN} = V_{EN} = 5$ V, 10 V/ms, $I_{Load} = 2$ A

**Fig. 19. Turn ON $V_{BIAS}$**




$V_{BIAS} = V_{IN} = V_{EN} = 5$ V, 10 V/ms, $I_{Load} = 2$ A

**Fig. 20. Turn OFF $V_{BIAS}$**

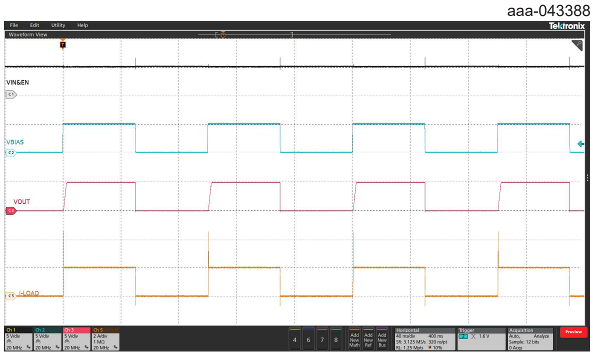



$V_{EN} = V_{IN} = 1.5$ V

$V_{BIAS}$: 0 V>1.5 V>3.3 V>5.5 V>3.3 V>1.5 V>0 V

$R_L$ = floating

**Fig. 21. $V_{BIAS}$ transient**

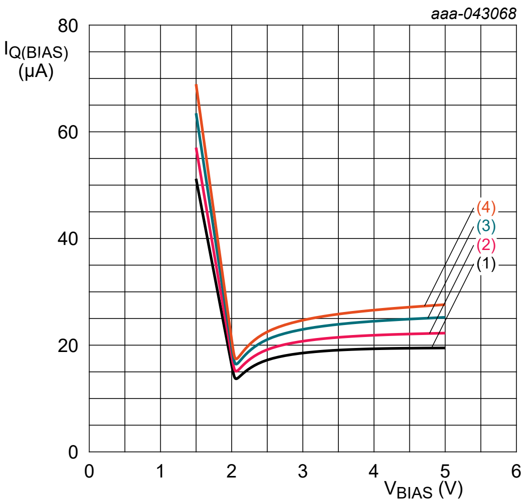



$V_{EN} = V_{IN} = 5$ V

$V_{BIAS} = 5$ V, 10 Hz

$I_L = 2$ A

**Fig. 22. $V_{BIAS}$ toggle**



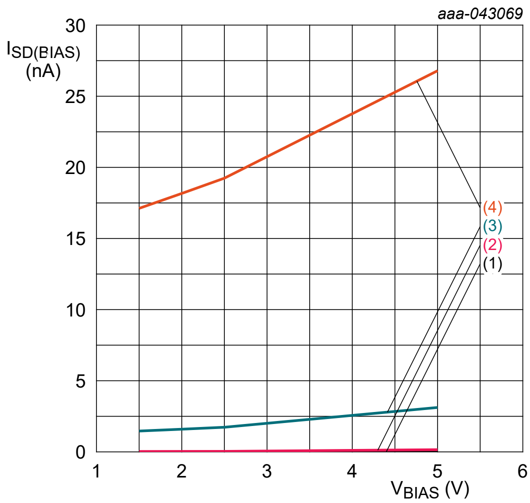

(1) $T_{amb}$ = -40 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 85 °C

(4) $T_{amb}$ = 105 °C

**Fig. 23. BIAS quiescent current vs BIAS voltage**



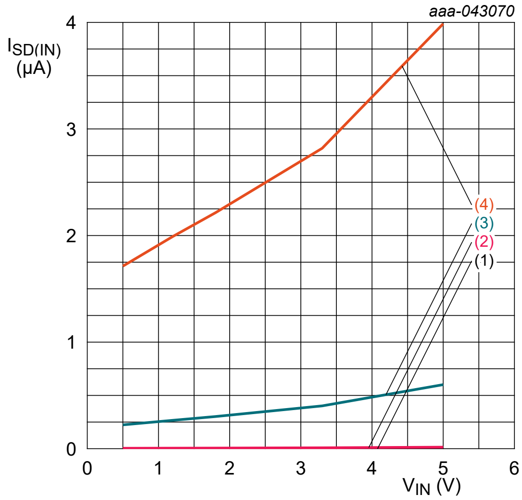

(1) $T_{amb}$ = -40 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 85 °C

(4) $T_{amb}$ = 105 °C

**Fig. 24. BIAS shutdown current vs BIAS voltage**



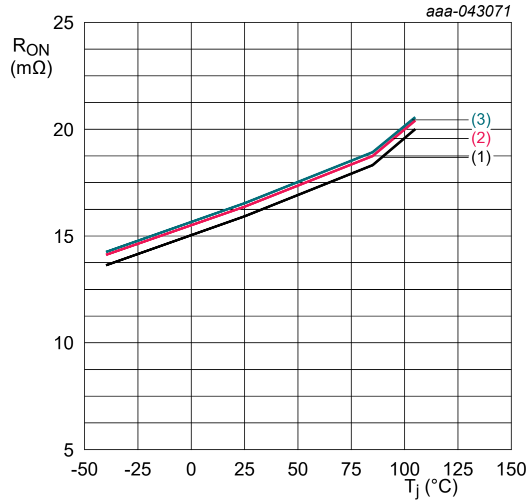

(1) $T_{amb}$ = -40 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 85 °C

(4) $T_{amb}$ = 105 °C

**Fig. 25. VIN OFF-state supply current vs input voltage**



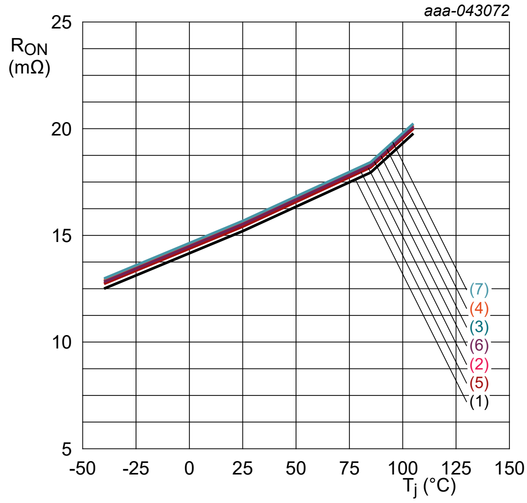

$V_{BIAS}$ = 1.5 V

(1) $V_{IN}$ = 0.5 V

(2) $V_{IN}$ = 1.2 V

(3) $V_{IN}$ = 1.5 V

**Fig. 26. ON resistance vs ambient temperature**




$V_{BIAS}$ = 5 V

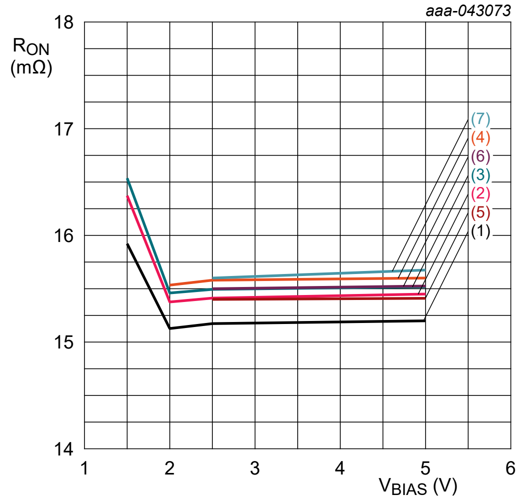
(1) $V_{IN}$ = 0.5 V; (2) $V_{IN}$ = 1.2 V

(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. 27. ON resistance vs ambient temperature**



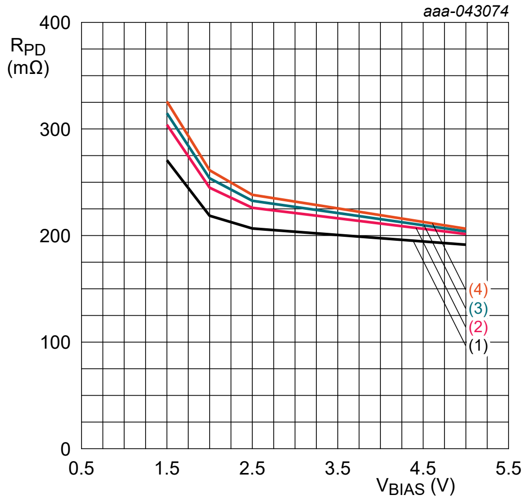

(1) $V_{IN}$ = 0.5 V; (2) $V_{IN}$ = 1.2 V

(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. 28. ON resistance vs BIAS voltage**




(1) $T_{amb}$ = -40 °C
(2) $T_{amb}$ = 25 °C
(3) $T_{amb}$ = 85 °C
(4) $T_{amb}$ = 105 °C

**Fig. 29. Output pull-down resistance vs BIAS voltage**

# 15. Detailed description

## 15.1. Overview

The NPS3005 consists of a 6 A rated N-channel MOSFET (NMOS) transistor with single-channel. The device has configured adjustable slew rate for specific soft start. The OUT pin will be pulled low when the device is disabled. NPS3005 also has thermal shutdown to prevent any damage from overheating.

## 15.2. Functional diagram

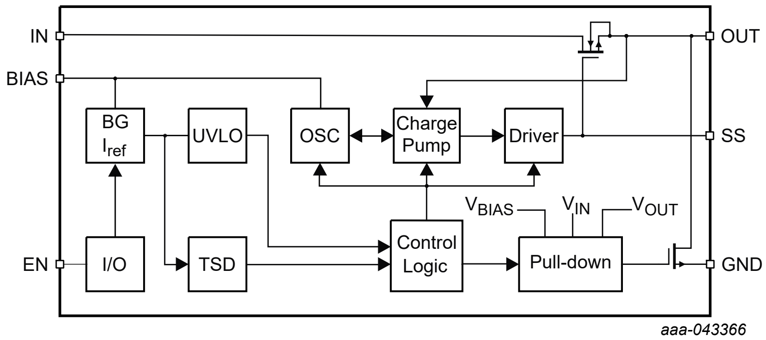



**Fig. 30. Functional diagram**

## 15.3. 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

To obtain a stable ON resistance, the NPS3005 introduces an additional bias pin, which is connected to the charge pump inside the chip to provide a stable supply voltage for the internal MOSFET.

It is highly recommended to keep the IN pin voltage not larger than the BIAS pin voltage. The device will still be functional if $V_{IN} > V_{BIAS}$ but the ON resistance will be larger.

### Adjustable Soft Start

NPS3005 has built in adjustable Soft Start which helps to reduce output current peak, thus to reduce the voltage drop of the input voltage. Soft start time can be adjusted via an external capacitor connected between SS pin and GND. The quick output discharge feature not only prevents output pin from being floating when disabled but also helps to adjust falling time with an external resistor.

### Quick output discharge

An internal 230 Ω pull-down resistor is connected between OUT pin and GND when the NPS3005 is disabled to prevent the OUT pin from being floating.

# 16. Application information

The typical application circuit is shown in Fig. 31. Component selection is explained below.

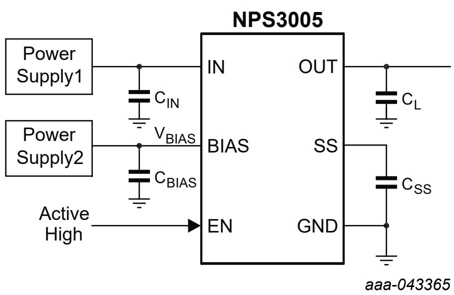
## Input Capacitor

A capacitor of 10 µF or higher value is recommended to be placed close to the IN pins of NPS3005. This capacitor can reduce the voltage drop caused by the in-rush current during the turn-on transient of the load switch. A higher value capacitor can be used to further reduce the voltage drop during high-current application.

## Output Capacitor

A capacitor of 1 µF or 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
$C_{IN}$ = 10 µF
$C_{BIAS}$ = 1 µF
$C_L$ = 1 µF

**Fig. 31. Typical application circuit**

# 17. Layout

## Power supply recommendations

The NPS3005 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 dipping 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

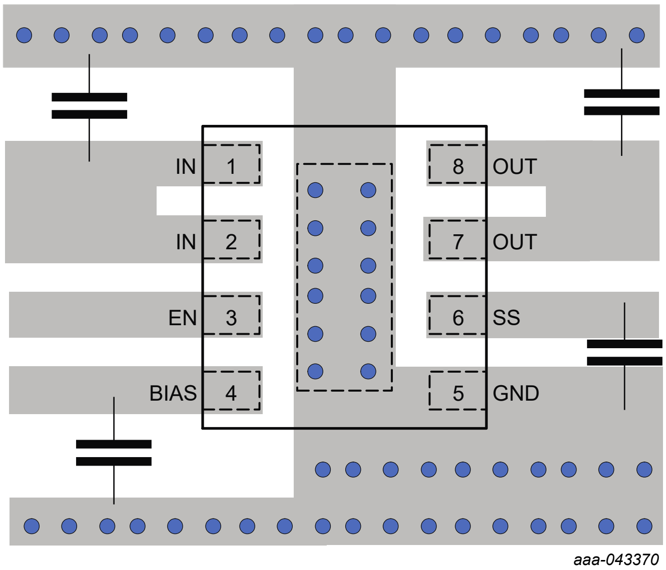



**Fig. 32. Layout example**

# 18. 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:

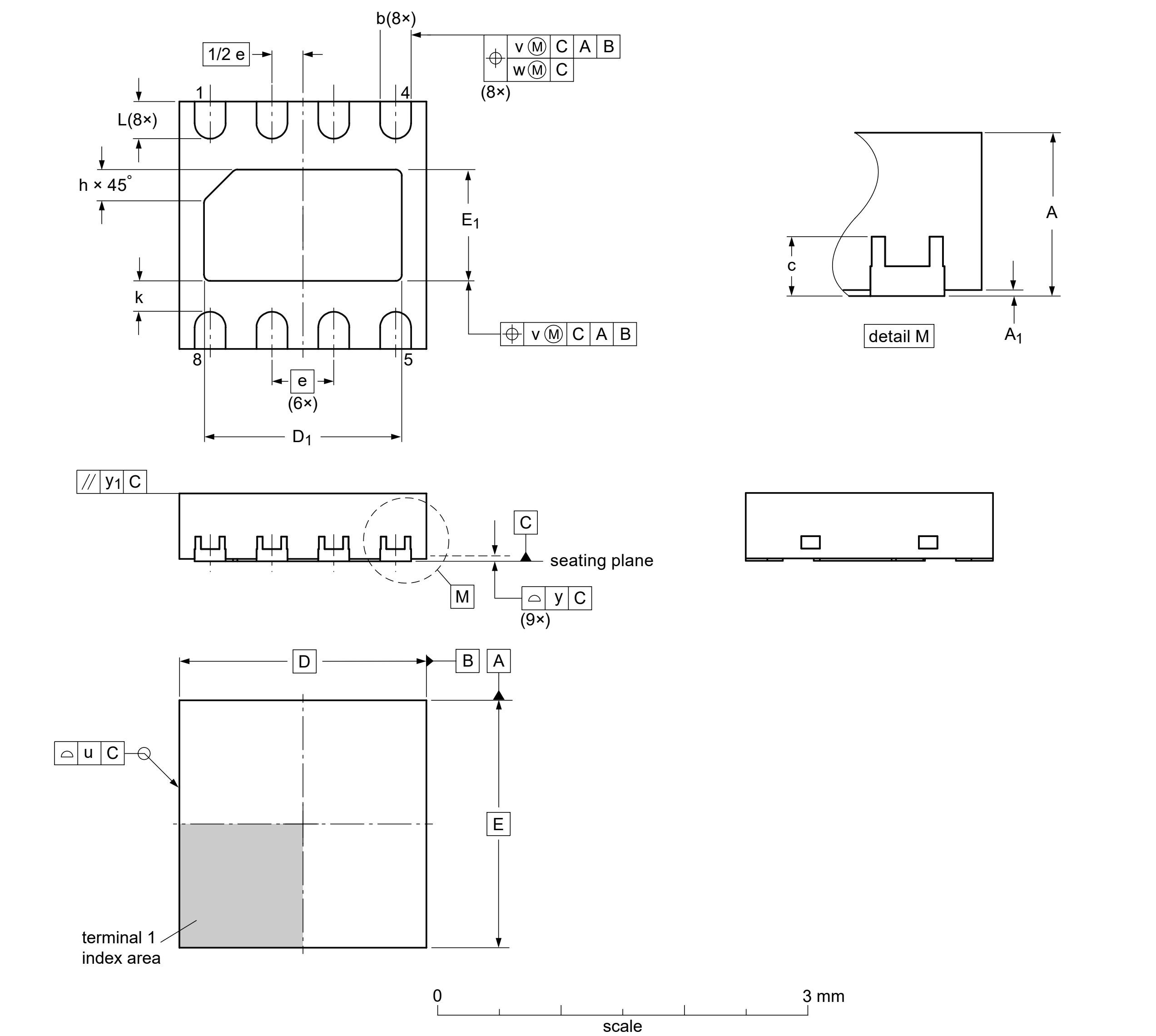
$$P_{D(MAX)} = \frac{T_{j(MAX)} - T_{amb}}{\theta_{JA}}$$

Where:

$P_{D(MAX)}$ = maximum allowable power dissipation
$T_{j(MAX)}$ = maximum allowable junction temperature (150 °C for the NPS3005 devices)
$T_{amb}$ = ambient temperature of the device
$\theta_{JA}$ = junction to air thermal impedance. This parameter is highly dependent upon board layout.

## 19. 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 | A1 | b | c | D | D1 | E | E1 | e | h | k | L | u | v | w | y | y1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | max | 0.80 | 0.05 | 0.30 | 0.2 REF | 2.0 BSC | 1.7 | 2.0 BSC | 1.0 | 0.5 BSC | 0.25 REF | 0.25 REF | 0.4 | 0.1 | 0.1 | 0.05 | 0.05 | 0.05 |
| | nom | 0.75 | | 0.25 | | | 1.6 | | 0.9 | | | | 0.3 | | | | | |
| | min | 0.70 | 0 | 0.20 | | | 1.5 | | 0.8 | | | | 0.2 | | | | | |

*sot8067-1_po*

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

**Fig. 33. Package outline SOT8067-1 (HWSON8)**

# 20. Abbreviations

**Table 11. Abbreviations**

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

# 21. Revision history

**Table 12. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| NPS3005 v.1.1 | 20250610 | Product data sheet | - | - |
| Modifications: | • Fig. 1, Fig. 4, Fig. 28 and Fig. 31 have changed. | | | |
| NPS3005 v.1.2 | 20250604 | Product data sheet | - | - |

# 22. 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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