

The NCP346 Overvoltage Protection circuit (OVP) protects sensitive electronic circuitry from overvoltage transients and power supply faults when used in conjunction with an external P-channel

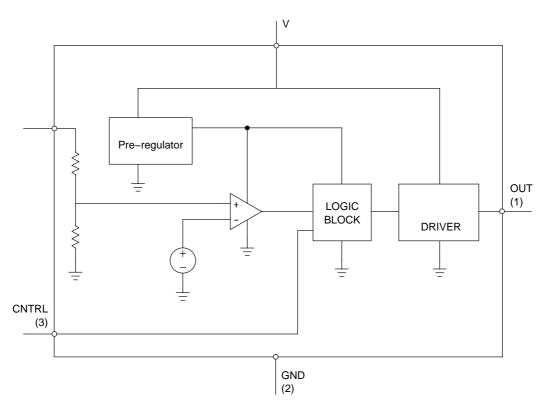


Figure 2. Detailed Block Diagram

MAXIMUM RATINGS ($T_A = 25$ °C unless otherwise noted.)

Rating	Pin	Symbol	Min	Max	Unit
OUT Voltage to GND	1	Vo	-0.3	30	V
Input and CNTRL Pin Voltage to GND	4	V _{input}	-0.3	30	V
	3	V _{CNTRL}	-0.3	13	
Input Pin Voltage to V _{CC}	4, 5	V(V _{CC,} IN)	-0.3	15	V
V _{CC} Maximum Range	5	V _{CC(max)}	-0.3	30	V
Maximum Power Dissipation at T _A = 85°C	-	P _D	_	0.216	W
Thermal Resistance, Junction-to-Air	-	$R_{ heta JA}$	_	300	°C/W
Junction Temperature	-	TJ	_	150	°C
Operating Ambient Temperature	-	T _A	-40	85	°C
V _{CNTRL} Operating Voltage	3	-	0	5.0	V
Storage Temperature Range	-	T _{stg}	-65	150	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

ATTRIBUTES

Characteristic	Value
ESD Protection Human Body Model (HBM) per JEDEC Standard JESD22–A114 Machine Model (MM) per JEDEC Standard JESD22–A114	≤ 2.5 kV ≤ 250 V
Moisture Sensitivity, Indefinite Time Out of Drypack (Note 1)	Level 1
Transistor Count	89
Latchup Current Maximum Rating per JEDEC Standard EIA/JESD78	≤ 150 mA

^{1.} For additional Moisture Sensitivity information, refer to Application Note AND8003/D.

ELECTRICAL CHARACTERISTICS (NCP346SN1T1)

(For typical values $T_A = 25$ °C, for min/max values $T_A = -40$ °C to +85°C unless otherwise noted.)

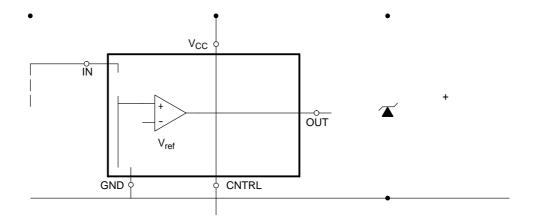
Characteristic	Pin	Symbol	Min	Тур	Max	Unit
V _{CC} Operating Voltage Range	5	l				

ELECTRICAL CHARACTERISTICS (NCP346SN2T1)

(For typical values $T_A = 25$ °C, for min/max values $T_A = -40$ °C to +85°C unless otherwise noted.)

Characteristic	Pin	Symbol	Min	Тур	Max	Unit
V _{CC} Operating Voltage Range	5	V _{CC(opt)}	2.5	-	25	V
Total Supply Current (IN Connected to V_{CC} ; ON Mode, V_{CC} = 5.0 V, CNTRL Pin Floating, Steady State)	4, 5	I _{cc on}	-	650	1200	μΑ
Total Supply Current (IN Connected to V_{CC} ; OFF Mode Driven by CNTRL Pin, V_{CC} = 5.0 V, V_{CNTRL} = 1.5 V, Steady State)	4, 5	I _{cc off} CNTRL	-	700	1200	μΑ
Total Supply Current (IN Connected to V_{CC} ; OFF Mode Driven by Overvoltage, V_{CC} = 6.0 V, CNTRL Pin Floating, Steady State)	4, 5	I _{cc off} IN	-	750	1200	μΑ
Input Threshold (IN Connected to V _{CC} ; V _{CC} Increasing)	4	V _{th} (LH)	5.3	5.5	5.7	V
Input Threshold (IN Connected to V _{CC} ; V _{CC} Decreasing)	4	V _{th} (HL)	5.3	5.45	5.7	V
Input Hysteresis (IN Connected to V _{CC})	4	V_{hyst}	-	50	_	mV

APPLICATION INFORMATION



Normal Operation

Figure 1 illustrates a typical configuration. The external adapter provides power to the protection system so the circuitry is only active when the adapter is connected. The

(eq. 10)

Design Steps for Adjusting the Overvoltage Threshold

- 1. Use Typical R_{in} , and V_{th} Values from the Electrical Specifications
- 2. Minimize R_{in} Effect by Selecting $R_1 \ll R_{in}$ since: $V_{OV} = V_{th}(1 + R_1/R_2 + R_1/R_{in}). \tag{eq. 6}$
- 3. Let $X = R_{in} / R_1 = 100$.
- 4. Identify Required Nominal Overvoltage Threshold.
- 5. Calculate nominal R_1 and R_2 from Nominal Values: $R_1 = R_{in}/X$ (eq. 7)

$$R_2 = \frac{R_1}{(V_{OV}/V_{th} - R_1/R_{in} - 1)}$$
 (eq. 8)

- Pick Standard Resistor Values as Close as Possible to these Values
- Use min/max Data and Resistor Tolerances to
 Determine Overvoltage Detection Tolerance:
 VOVmin = Vthmin(1 + R₁min/R₂max + R₁min/R_{inmax})

 $V_{OVtyp} = V_{thtyp}(1 + R_{1typ}/R_{2typ} + R_{1typ}/R_{intyp})$

$$V_{OVmax} = V_{thmax}(1 + R_{1min}R_{2max} + R_{1max}/R_{inmin})$$
 (eq. 11)

The specification takes into account the hysteresis of the comparator, so the minimum input threshold voltage (V_{th}) is the falling voltage detection point and the maximum is the rising voltage detection point. One should design the input supply such that its maximum supply voltage in normal operation is less than the minimum desired overvoltage threshold.

8. Use worst case resistor tolerances to determine the maximum $V(V_{CC},IN)$

$$V(V_{CC}, IN) min = V_{CCmax} * (R1min/(R1min + R2max))$$
(eq. 12)

$$V(V_{CC}, IN)typ = V_{CC_{max}} * (R1typ/(R1typ + R2typ))$$
 (eq. 13)

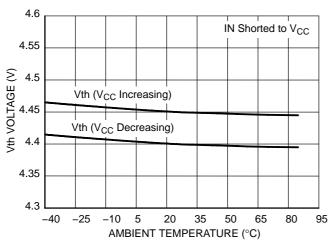
$$V(V_{CC}, IN) max = V_{CCmax} * (R1max/(R1max + R2min))$$
(eq. 14)

This is shown empirically in Tables 2 through 4.

The following tables show an example of obtaining a 6 V detection voltage from the NCP346SN2T2, which has a typical V_{th} of 5.5 V.

Table 1. Design Steps 1-5

Parameter	Typical	Design Steps
IN Pin Input Impedance (I _N)	54000	(1)



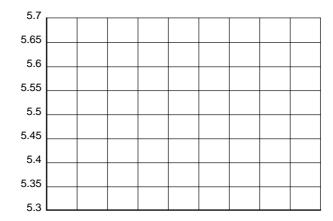


Figure 5. Typical Vth Variation vs. Temperature (NCP346SN1)

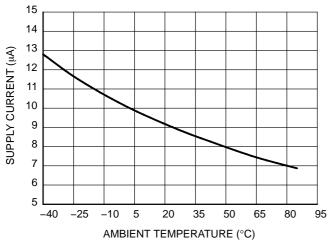


Figure 11. Typical OUT Sink Current vs. Temperature (NCP346SN1)

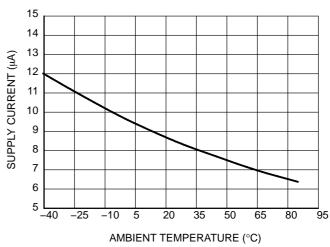


Figure 12. Typical OUT Sink Current vs. Temperature (NCP346SN2)

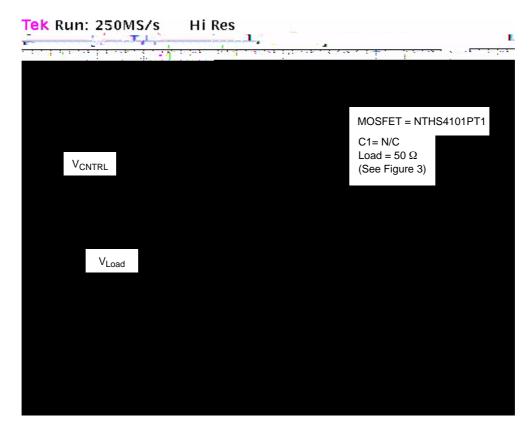


Figure 13. Typical Turn-off Time CNTRL (NCP346SN1)

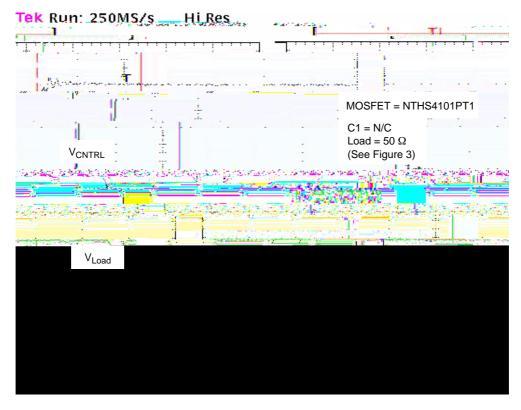


Figure 14. Typical Turn-off Time CNTRL (NCP346SN2)

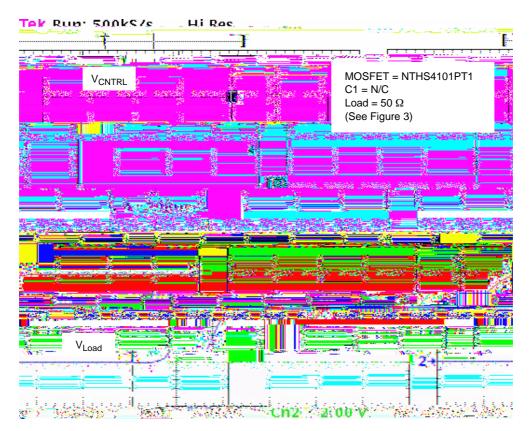


Figure 15. Typical Turn-on Time CNTRL (NCP346SN1)

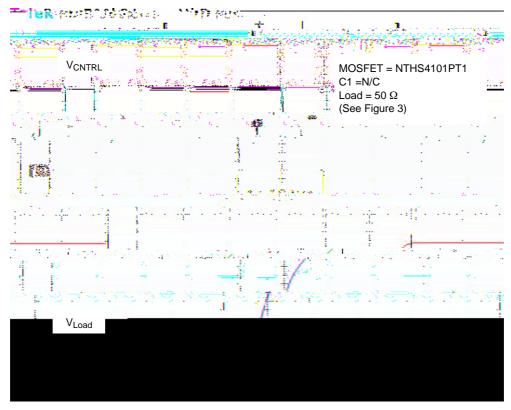


Figure 16. Typical Turn-on Time CNTRL (NCP346SN2)

THIN SOT-23-5 POWER DISSIPATION

The power dissipation of the Thin SOT–23–5 is a function of the pad size. This can vary from the minimum pad size for soldering to a pad size given for maximum power dissipation. Power dissipation for a surface mount device is determined by $T_{J(max)}$, the maximum rated junction temperature of the die, $R_{\theta JA}$, the thermal resistance from the device junction to ambient, and the operating temperature, T_A . Using the values provided on the data sheet for the Thin SOT–23–5 package, P_D can be calculated as follows:

$$P_{D} = \frac{T_{J(max)} - T_{A}}{R_{\theta JA}}$$

The values for the equation are found in the maximum ratings table on the data sheet. Substituting these values into the equation for an ambient temperature T_A of 25°C, one can calculate the power dissipation of the device which in this case is 400 milliwatts.

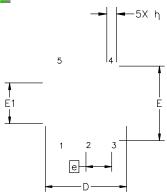
$$P_D = \frac{150^{\circ}C - 25^{\circ}C}{300^{\circ}C/W} = 417 \text{ milliwatts}$$

The 300°C/W for the Thin SOT-23-5 package assumes the use of the recommended footprint on a glass epoxy printed circuit board to achieve a power dissipation of 417mw.



TSOP-5 3.00x1.50x0.95, 0.95P **CASE 483** ISSUE P

DATE 01 APR 2024





GENERIC MARKING DIAGRAM*





Analog

Discrete/Logic

XXX = Specific Device Code

XXX = Specific Device Code = Date Code

= Assembly Location = Year

M

= Pb-Free Package

= Work Week

= Pb-Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking.
Pb–Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking. OUR Pb-FREE

STRATEGY AND SOLDERING DETAILS, PLAN

FORMATION ON

