

NCP346

O^V - V a - P - c IC

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

NCP346

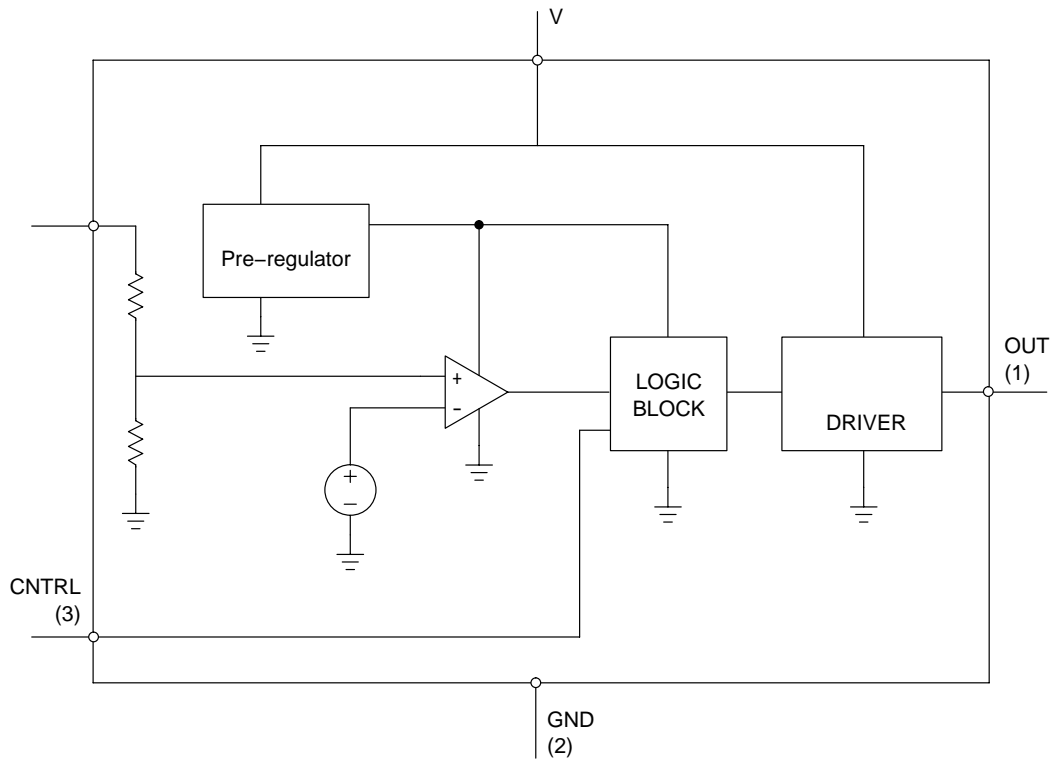


Figure 2. Detailed Block Diagram

NCP346

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

Rating	Pin	Symbol	Min	Max	Unit
OUT Voltage to GND	1	V _O	-0.3	30	V
Input and CNTRL Pin Voltage to GND	4	V _{input}	-0.3	30	V
	3	V _{CNTRL}	-0.3	13	V
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 _{θJA}	-	300	°C/W
Junction Temperature	-	T _J	-	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.

NCP346

ELECTRICAL CHARACTERISTICS (NCP346SN1T1)

(For typical values $T_A = 25^\circ\text{C}$, for min/max values $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ unless otherwise noted.)

Characteristic	Pin	Symbol	Min	Typ	Max	Unit
V_{CC} Operating Voltage Range	5					

NCP346

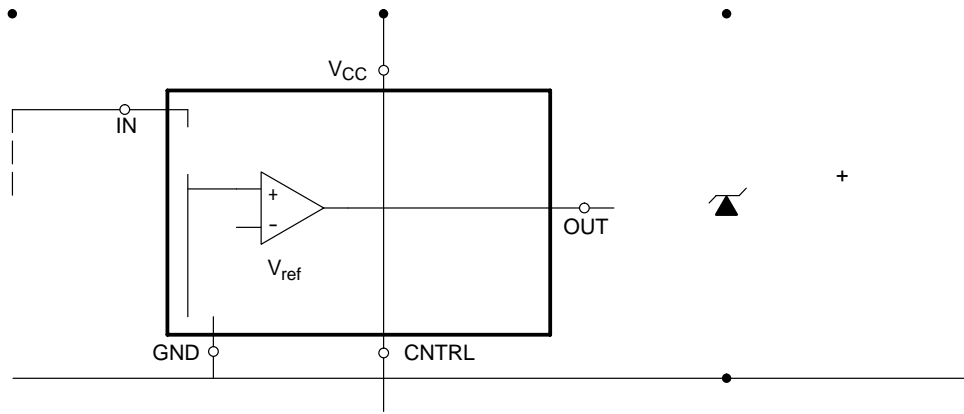
ELECTRICAL CHARACTERISTICS (NCP346SN2T1)

(For typical values $T_A = 25^\circ\text{C}$, for min/max values $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ unless otherwise noted.)

Characteristic	Pin	Symbol	Min	Typ	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, $V_{CC} = 5.0\text{ V}$, CNTRL Pin Floating, Steady State)	4, 5	$I_{cc\ on}$	–	650	1200	μA
Total Supply Current (IN Connected to V_{CC} ; OFF Mode Driven by CNTRL Pin, $V_{CC} = 5.0\text{ V}$, $V_{CNTRL} = 1.5\text{ V}$, Steady State)	4, 5	$I_{cc\ off\ CNTRL}$	–	700	1200	μA
Total Supply Current (IN Connected to V_{CC} ; OFF Mode Driven by Overvoltage, $V_{CC} = 6.0\text{ V}$, CNTRL Pin Floating, Steady State)	4, 5	$I_{cc\ off\ IN}$	–	750	1200	μA
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

NCP346

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

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:

$$V_{OV} = V_{th}(1 + R_1/R_2 + R_1/R_{in}). \quad (\text{eq. 6})$$
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:

$$R_1 = R_{in}/X \quad (\text{eq. 7})$$

$$R_2 = \frac{R_1}{(V_{OV}/V_{th} - R_1/R_{in} - 1)} \quad (\text{eq. 8})$$
6. Pick Standard Resistor Values as Close as Possible to these Values
7. Use min/max Data and Resistor Tolerances to Determine Overvoltage Detection Tolerance:

$$V_{OVmin} = V_{thmin}(1 + R_{1min}/R_{2max} + R_{1min}/R_{inmax}) \quad (\text{eq. 9})$$

$$V_{OVtyp} = V_{thtyp}(1 + R_{1typ}/R_{2typ} + R_{1typ}/R_{intyp}) \quad (\text{eq. 10})$$

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

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 $V(V_{CC}, IN)$

$$V(V_{CC}, IN)_{min} = V_{CCmax} * (R_{1min}/(R_{1min} + R_{2max})) \quad (\text{eq. 12})$$

$$V(V_{CC}, IN)_{typ} = V_{CCmax} * (R_{1typ}/(R_{1typ} + R_{2typ})) \quad (\text{eq. 13})$$

$$V(V_{CC}, IN)_{max} = V_{CCmax} * (R_{1max}/(R_{1max} + R_{2min})) \quad (\text{eq. 14})$$

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.

NCP346

Table 1. Design Steps 1–5

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

NCP346

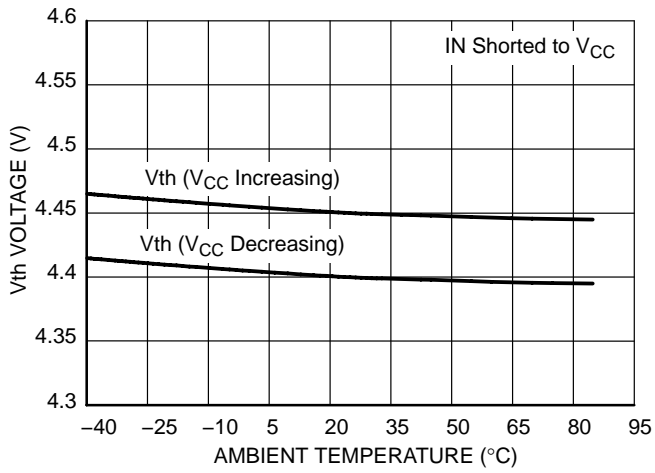
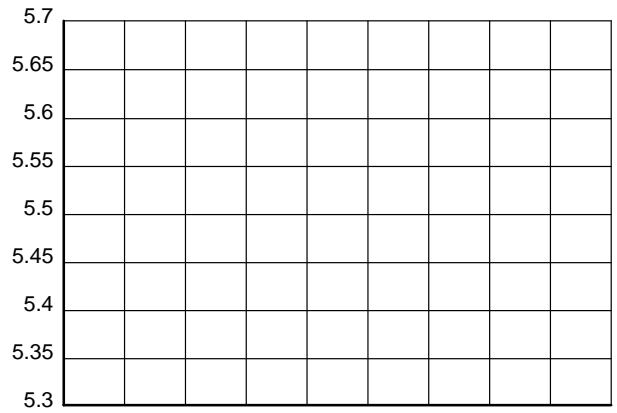


Figure 5. Typical V_{th} Variation vs. Temperature (NCP346SN1)



0 2.5 5 7.5 10 12.5 15 17.5 20 22.5 25 27.530

NCP346

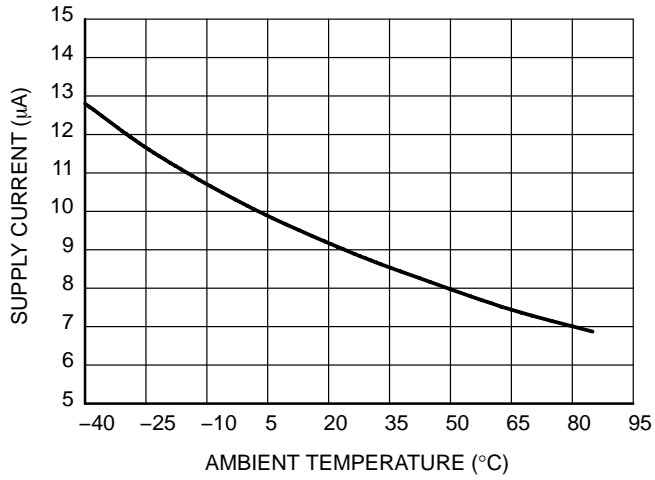


Figure 11. Typical OUT Sink Current vs. Temperature (NCP346SN1)

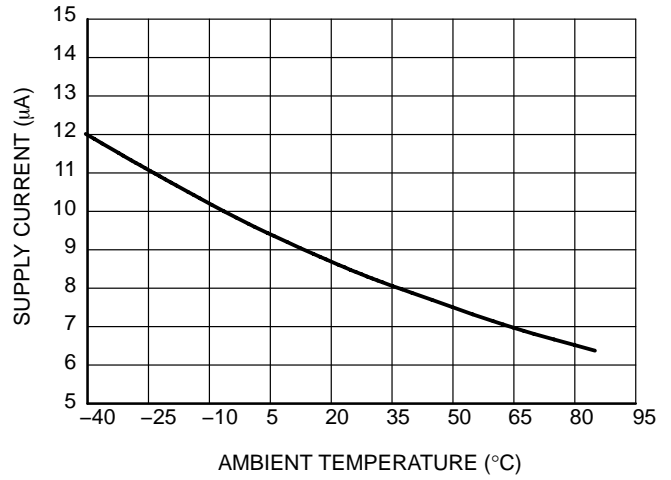


Figure 12. Typical OUT Sink Current vs. Temperature (NCP346SN2)

NCP346

Tek Run: 250MS/s Hi Res

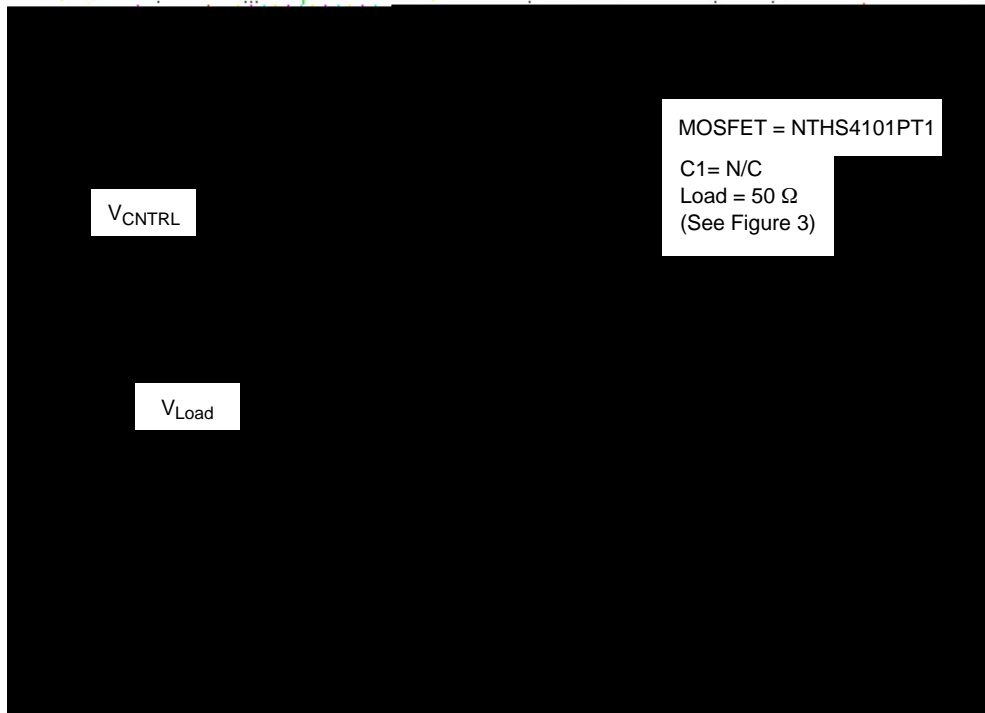


Figure 13. Typical Turn-off Time CNTRL (NCP346SN1)

Tek Run: 250MS/s Hi Res

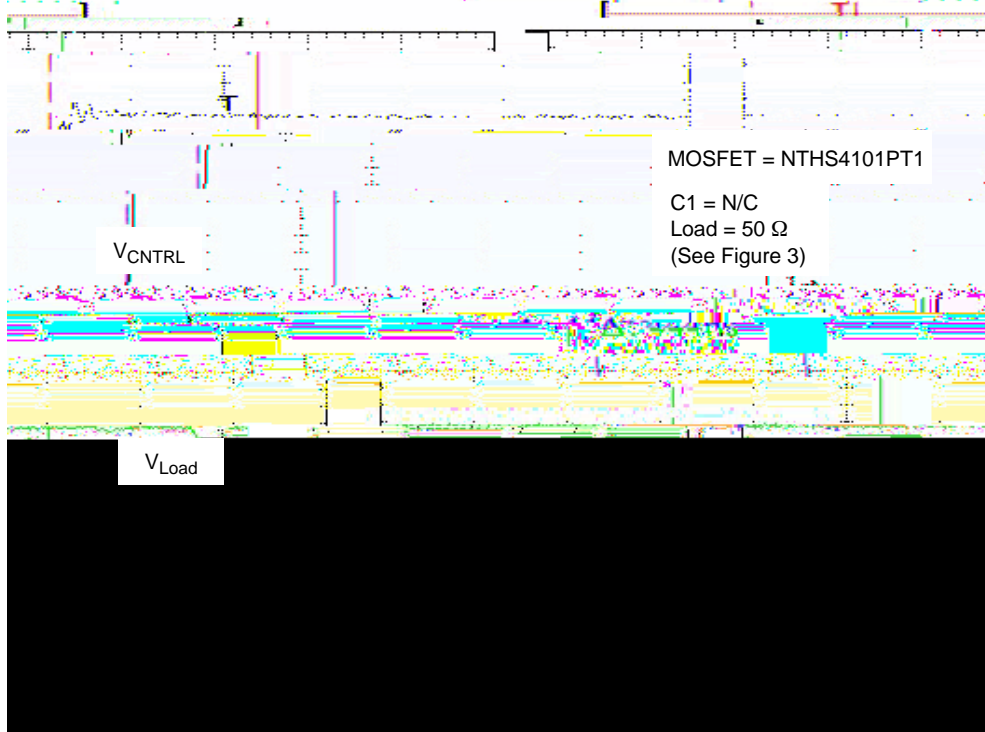


Figure 14. Typical Turn-off Time CNTRL (NCP346SN2)

NCP346

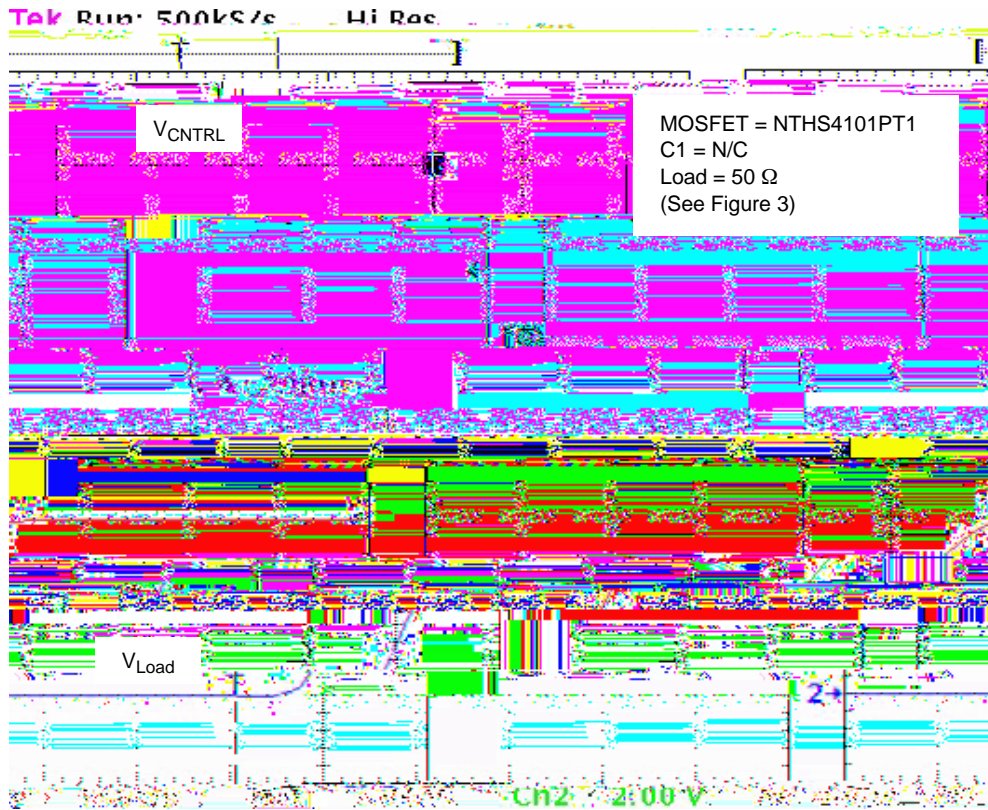


Figure 15. Typical Turn-on Time CNTRL (NCP346SN1)

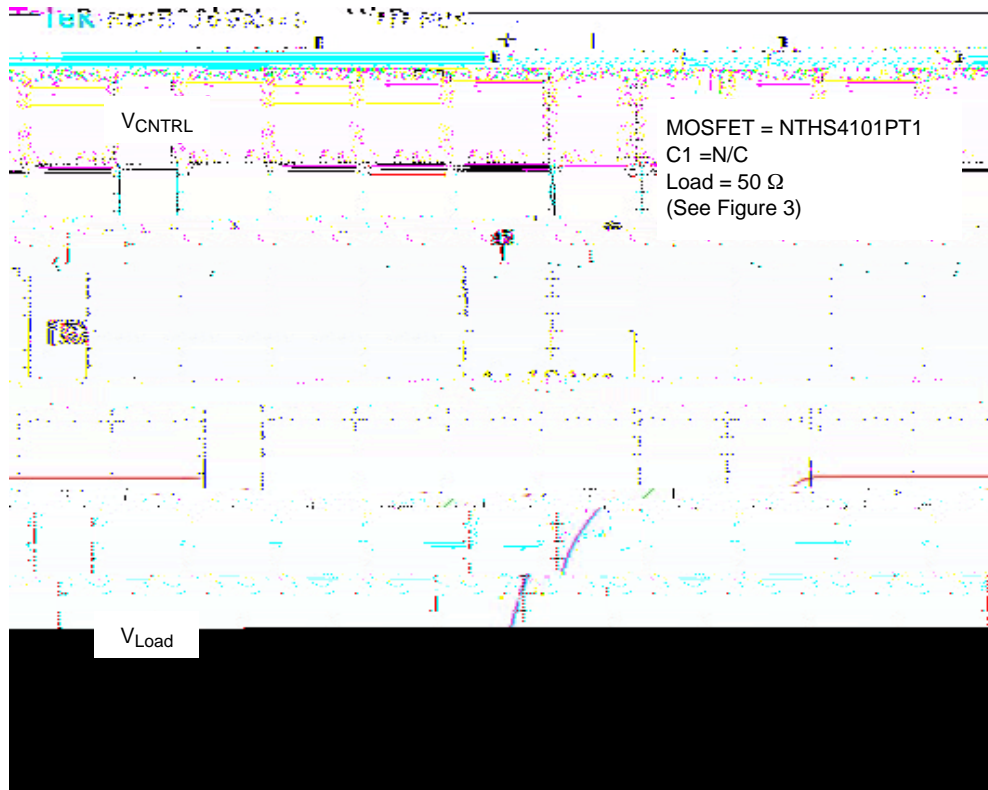


Figure 16. Typical Turn-on Time CNTRL (NCP346SN2)

NCP346

THIN SOT-23-5 POWER DISSIPATION

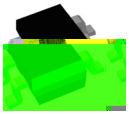
The power dissipation of the Thin SOT-23-5 is a function of the pad size. This can vary from the minimum pad size for soldering to a pad size given for maximum power dissipation. Power dissipation for a surface mount device is determined by $T_{J(max)}$, the maximum rated junction temperature of the 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:

$$P_D = \frac{T_{J(max)} - T_A}{R_{\theta JA}}$$

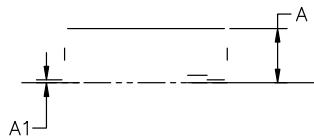
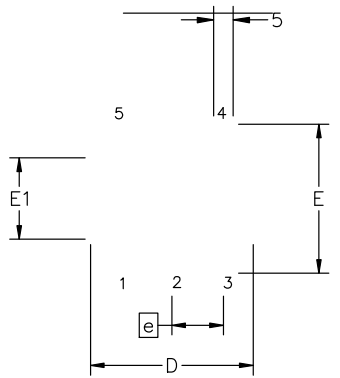
The values for the equation are found in the maximum ratings table on the data sheet. Substituting these values into the equation for an ambient temperature T_A of 25°C, one can calculate the power dissipation of the device which in this case is 400 milliwatts.

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

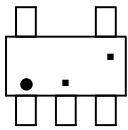
The 300°C/W for the Thin SOT-23-5 package assumes the use of the recommended footprint on a glass epoxy printed circuit board to achieve a power dissipation of 417mw.



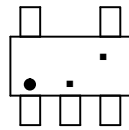
TSOP-5 3.00x1.50x0.95, 0.95P



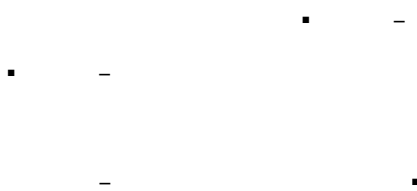
GENERIC MARKING DIAGRAM*



Analog



Discrete/Logic



onsemi, **onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi**
