NCS2220A

Low Voltage Comparator

The NCS2220A is an industry first sub−one volt, low power dual comparator. This device consumes only 0.85 μA per Comparator of supply current. It is guaranteed to operate at a low voltage of 0.85 V which allows it to be used in systems that require less than 1.0 V and is fully operational up to 6.0 V. Additional features include no output phase inversion with overdriven inputs, internal hysteresis, which allows for clean output switching, and rail−to−rail input and output performance. The NCS2220A is available in the tiny UDFN 1.6 X 1.6 package.

Features

- Operating Voltage of 0.85 V to 6.0 V
- Rail−to−Rail Input/Output Performance
- Low Supply Current of 7.5 μA per Comparator Typ
- No Phase Inversion with Overdriven Input Signals
- Internal Hysteresis
- Propagation Delay of 0.5 μs
- These are Pb−Free Devices

Typical Applications

- Single Cell NiCd/NiMH Battery Powered Applications
- Cellular Telephones
- Alarm and Security Systems
- Personal Digital Assistants

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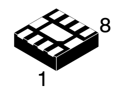
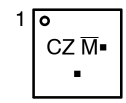
MARKING DIAGRAMS



UDFN8 1.6 X 1.6
MU SUFFIX
CASE 517AC



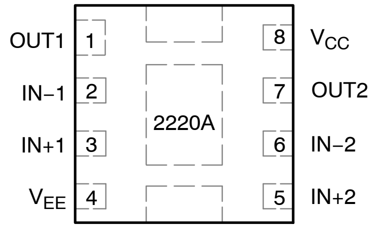
CZ	= Specific Device Code
M	= Date Code
▪	= Pb−Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
NCS2220AMUT1G	UDFN8 (Pb−Free)	3000/ Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.



Top View

NOTE: The NCS2220A has three exposed pads on the bottom side which may be used to reduce thermal resistance by soldering to a copper heat−spreader. Electrically the exposed pads must be allowed to float.

Figure 1. Pin Connections

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Supply Voltage Range (V_{CC} to V_{EE})	V_S	6.0	V
Non−inverting/Inverting Input to V_{EE}	–	−0.2 to (V_{CC} + 0.2)	V
Operating Junction Temperature	T_J	150	°C
Operating Ambient Temperature	T_A	−40 to +105	°C
Storage Temperature Range	T_{stg}	−65 to +150	°C
Output Short Circuit Duration Time (Note 1)	t_S	Indefinite	s
ESD Tolerance (Note 2) Human Body Model Machine Model	–	 2000 200	V
Thermal Resistance, Junction−to−Ambient UDFN	$R_{\theta JA}$	 350	°C/W

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.

1. The maximum package power dissipation limit must not be exceeded.

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

2. ESD data available upon request.

ELECTRICAL CHARACTERISTICS (For all values V_{CC} = 0.85 V to 6.0 V, V_{EE} = 0 V, T_A = 25°C, unless otherwise noted.) (Note 3)

Characteristics	Symbol	Min	Typ	Max	Unit
Input Hysteresis T_A = 25°C	V_{HYS}	2.0	4.5	20	mV
Input Offset Voltage	V_{IO}				mV
V_{CC} = 0.85 V					
T_A = 25°C		−10	0.5	+10	
T_A = −40°C to 105°C		−12	–	+12	
V_{CC} = 3.0 V					
T_A = 25°C		−6.0	0.5	+6.0	
T_A = −40°C to 105°C		−8.0	–	+8.0	
V_{CC} = 6.0 V					
T_A = 25°C		−5.0	0.5	+5.0	
T_A = −40°C to 105°C		−7.0	–	+7.0	
Common Mode Voltage Range	V_{CM}	–	V_{EE} to V_{CC}	–	V
Output Short−Circuit Sourcing or Sinking	I_{SC}	–	60	–	mA
Common Mode Rejection Ratio V_{CM} = V_{CC}	CMRR	53	70	–	dB
Input Bias Current	I_{IB}	–	1.0	–	pA
Power Supply Rejection Ratio ΔV_S = 2.575 V	PSRR	45	80	–	dB
Supply Current per Comparator	I_{CC}				μA
V_{CC} = 0.85 V					
T_A = 25°C		–	7.5	15	
T_A = −40°C to 105°C			–	17	
V_{CC} = 3.0 V					
T_A = 25°C		–	8.0	15	
T_A = −40°C to 105°C			–	17	
V_{CC} = 6.0 V					
T_A = 25°C		–	9.0	15	
T_A = −40°C to 105°C			–	17	
Output Voltage High	V_{OH}				V
V_{CC} = 0.85 V, I_{source} = 0.5 mA					
T_A = 25°C		V_{CC} – 0.25	V_{CC} – 0.12	–	
T_A = −40°C to 105°C		V_{CC} – 0.275	–		
V_{CC} = 3.0 V, I_{source} = 3.0 mA					
T_A = 25°C		V_{CC} – 0.3	V_{CC} – 0.12	–	
T_A = −40°C to 105°C		V_{CC} – 0.35	–		
V_{CC} = 6.0 V, I_{source} = 5.0 mA					
T_A = 25°C		V_{CC} – 0.3	V_{CC} – 0.17	–	
T_A = −40°C to 105°C		V_{CC} – 0.35	–		
Output Voltage Low	V_{OL}				V
V_{CC} = 0.85 V, I_{sink} = 0.5 mA					
T_A = 25°C		–	V_{EE} + 0.10	V_{EE} + 0.25	
T_A = −40°C to 105°C			–	V_{EE} + 0.275	
V_{CC} = 3.0 V, I_{sink} = 3.0 mA					
T_A = 25°C		–	V_{EE} + 0.12	V_{EE} + 0.3	
T_A = −40°C to 105°C			–	V_{EE} + 0.35	
V_{CC} = 6.0 V, I_{sink} = 5.0 mA					
T_A = 25°C		–	V_{EE} + 0.12	V_{EE} + 0.3	
T_A = −40°C to 105°C			–	V_{EE} + 0.35	
Propagation Delay 20 mV Overdrive, C_L = 15 pF					μs
	t_{PHL}	–	0.5	–	
	t_{PLH}	–	0.5	–	
Output Fall Time V_{CC} = 6.0 V, C_L = 50 pF (Note 4)	t_{FALL}	–	20	–	ns
Output Rise Time V_{CC} = 6.0 V, C_L = 50 pF (Note 4)	t_{RISE}	–	16	–	ns

3. The limits over the extended temperature range are guaranteed by design only.
4. Input signal: 1 kHz, squarewave signal with 10 ns edge rate.

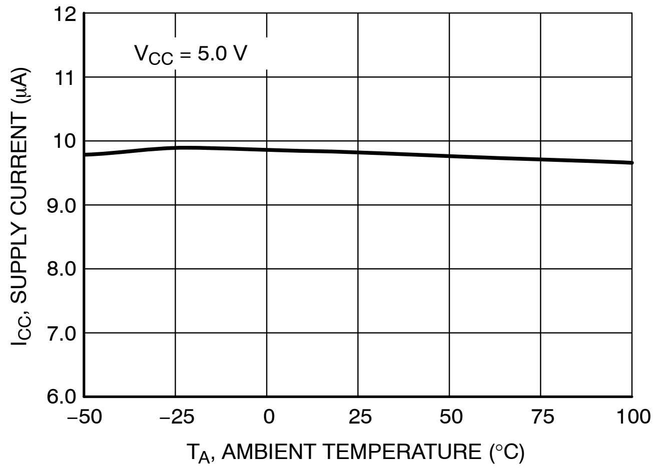


Figure 1. Supply Current versus Temperature/Comparator

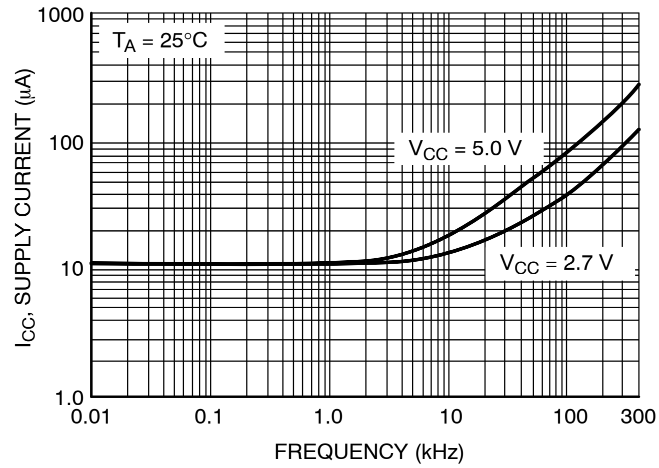


Figure 2. Supply Current versus Output Transition Frequency/Comparator

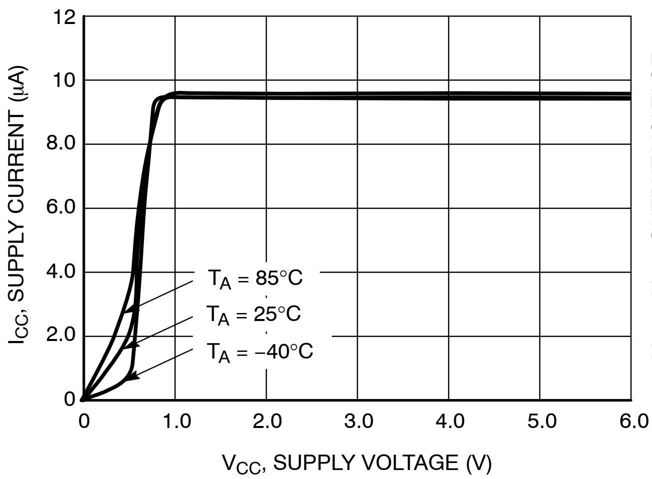


Figure 3. Supply Current versus Supply Voltage/Comparator

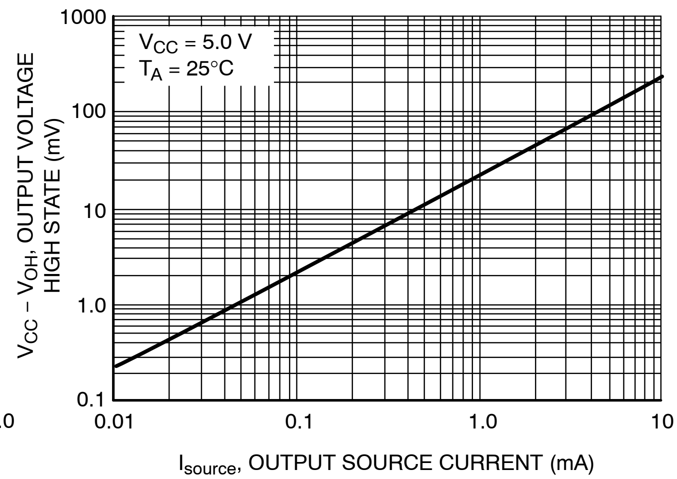


Figure 4. Output Voltage High State versus Output Source Current

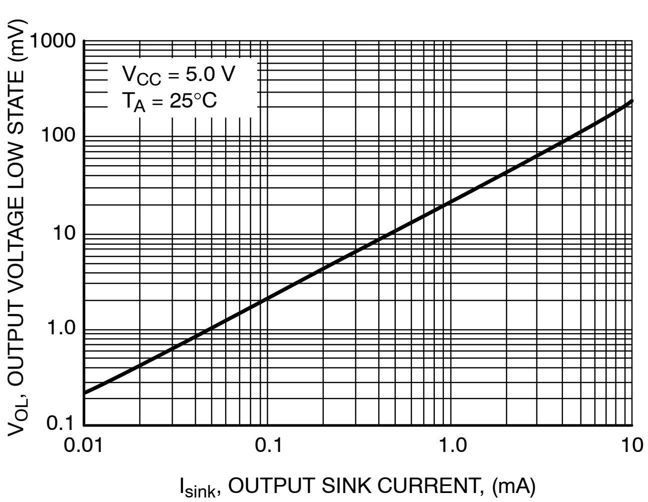


Figure 5. Output Voltage Low State versus Output Sink Current

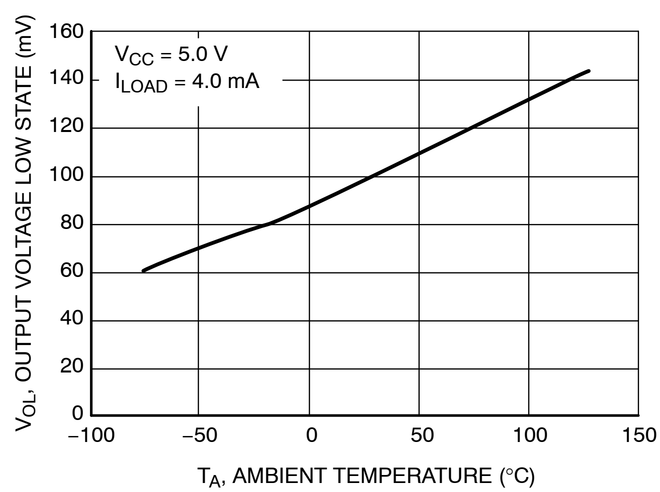


Figure 6. Output Voltage Low State versus Temperature

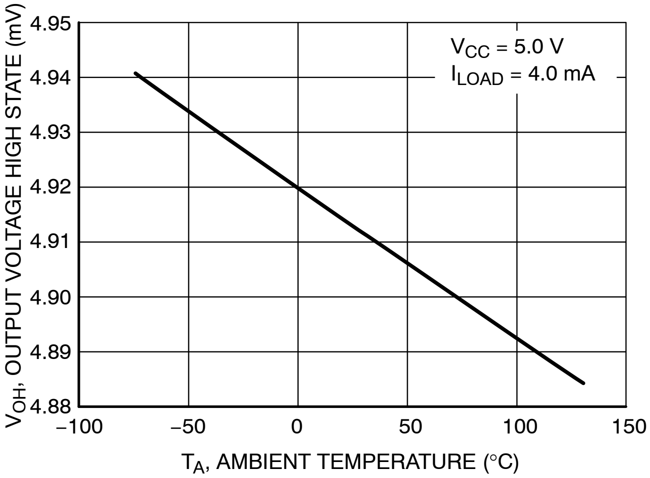


Figure 7. Output Voltage High State versus Temperature

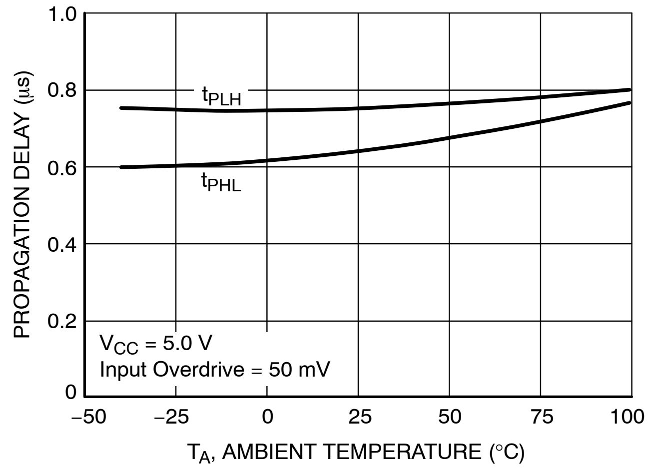


Figure 8. Propagation Delay versus Temperature

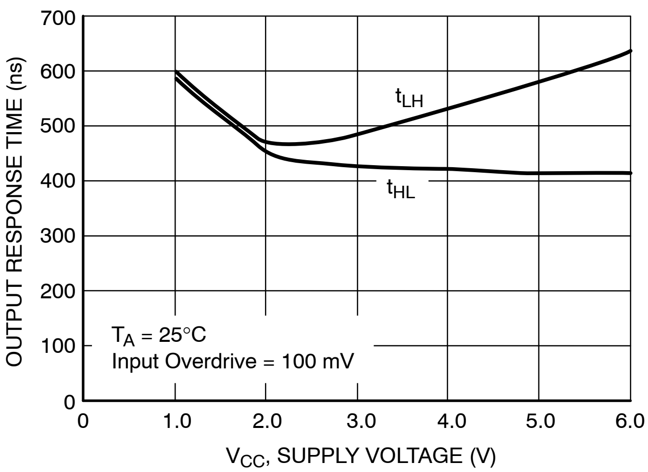


Figure 9. Output Response Time versus Supply Voltage

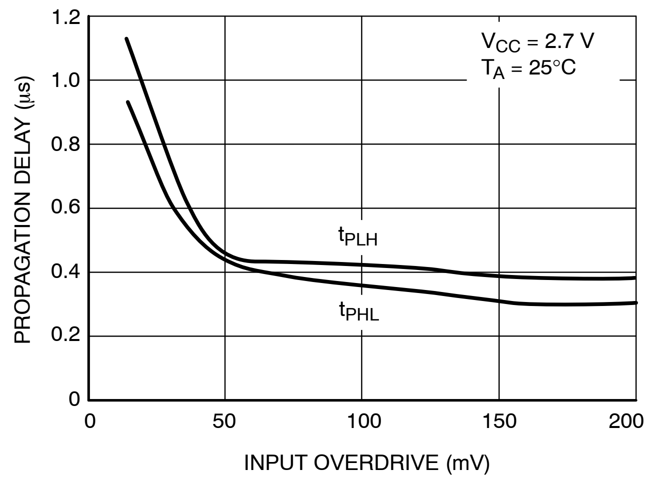


Figure 10. Propagation Delay versus Input Overdrive

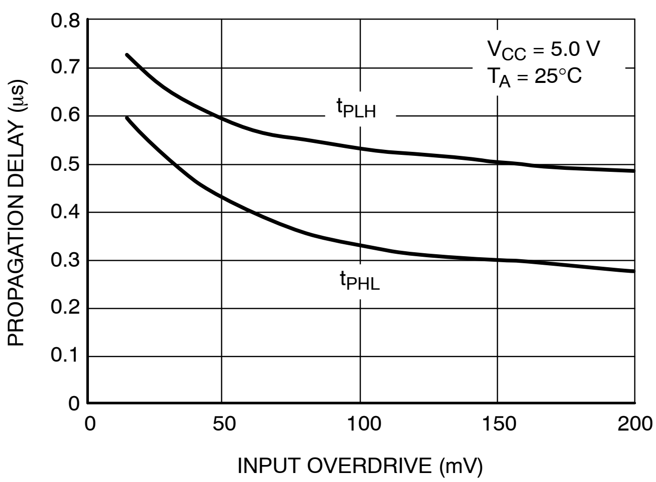


Figure 11. Propagation Delay versus Input Overdrive

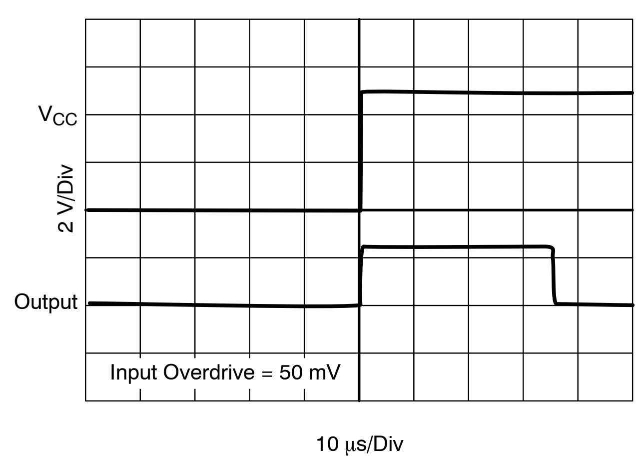


Figure 12. Powerup Delay

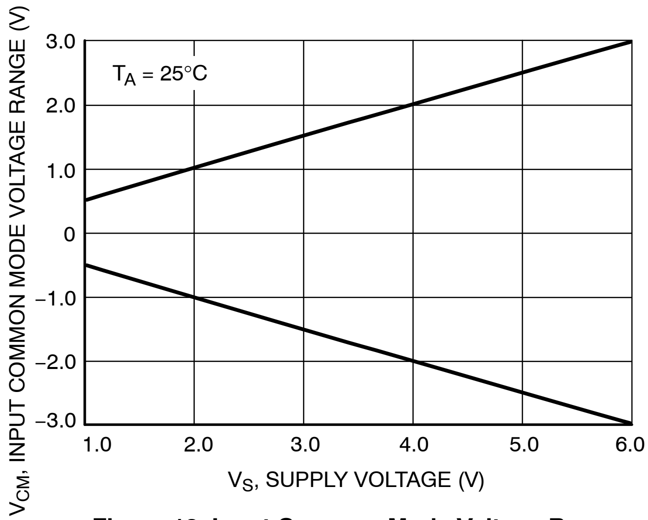


Figure 13. Input Common Mode Voltage Range versus Supply Voltage

OPERATING DESCRIPTION

The NCS2220A is an industry first sub−one volt, low power comparator. This device is designed for rail−to−rail input and output performance. This device consumes only 7.5 μA/Comparator of supply current while achieving a typical propagation delay of 0.5 μs at a 20 mV input overdrive. Figures 10 and 11 show propagation delay with various input overdrives. This comparator is guaranteed to operate at a low voltage of 0.85 V up to 6.0 V. This is accomplished by the use of a modified analog CMOS process that implements depletion MOSFET devices. The common−mode input voltage range extends 0.1 V beyond the upper and lower rail without phase inversion or other adverse effects. This device has a typical internal hysteresis of ± 8.0 mV. This allows for greater noise immunity and clean output switching.

Output Stage

The NCS2220A has a complementary P and N Channel output stage that has capability of driving a rail−to−rail output swing with a load ranging up to 5.0 mA. It is designed such that shoot−through current is minimized while switching. This feature eliminates the need for bypass capacitors under most circumstances.

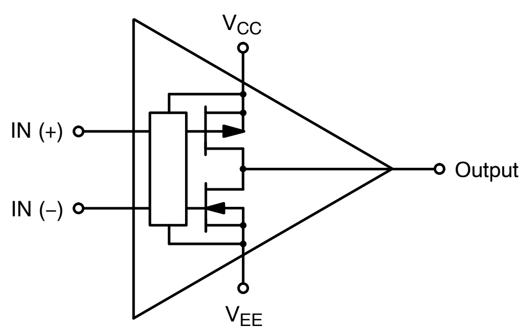
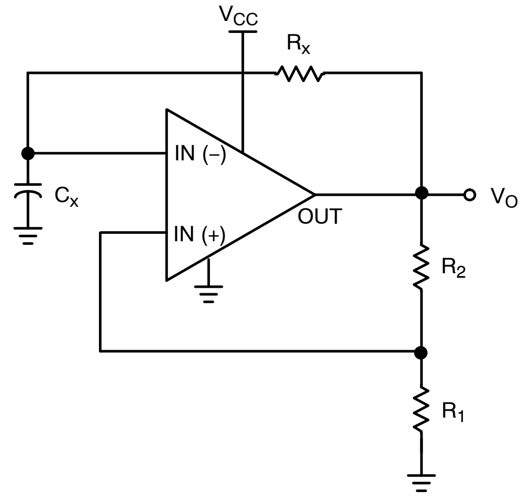


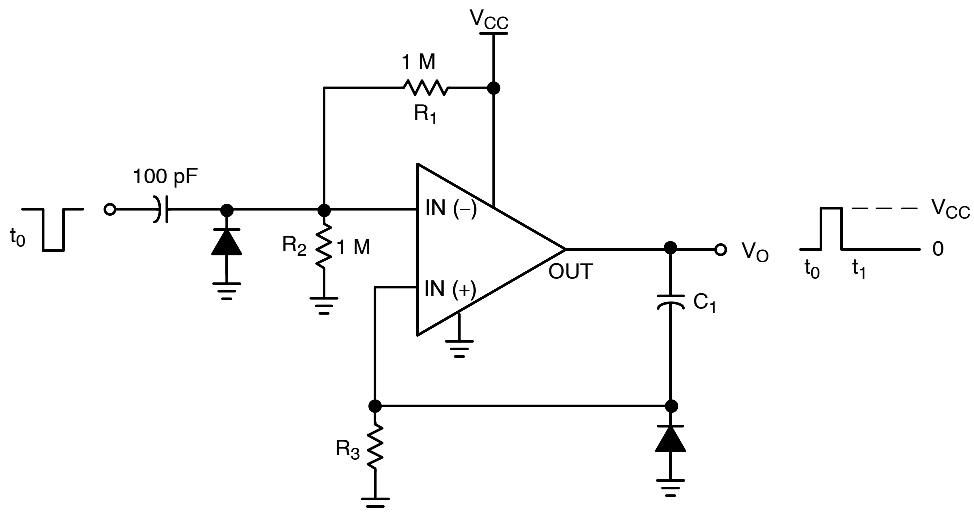
Figure 14. NCS2220A Complementary Output Configuration



The oscillation frequency can be programmed as follows:

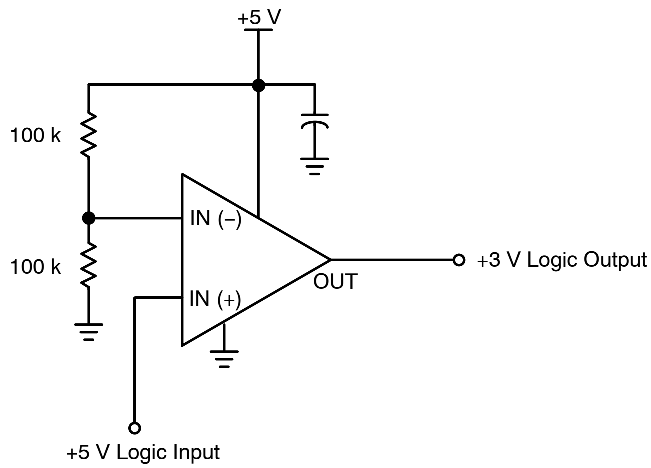
$$f = \frac{1}{T} = \frac{1}{2.2\ R_X C_X}$$

Figure 15. Schmitt Trigger Oscillator



The resistor divider R_1 and R_2 can be used to set the magnitude of the input pulse. The pulse width is set by adjusting C_1 and R_3.

Figure 16. One−Shot Multivibrator



This circuit converts 5 V logic to 3 V logic. Using the NCS2220/A allows for full 5 V logic swing without creating overvoltage on the 3 V logic input.

Figure 17. Logic Level Translator

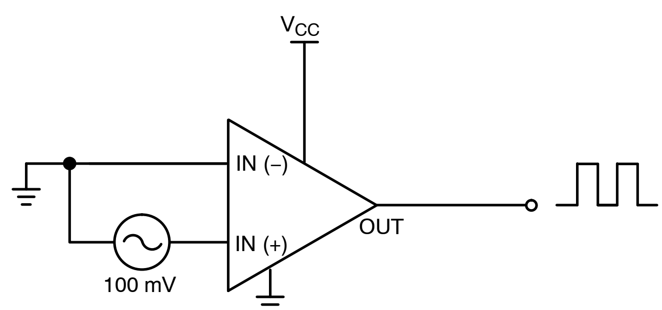
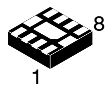


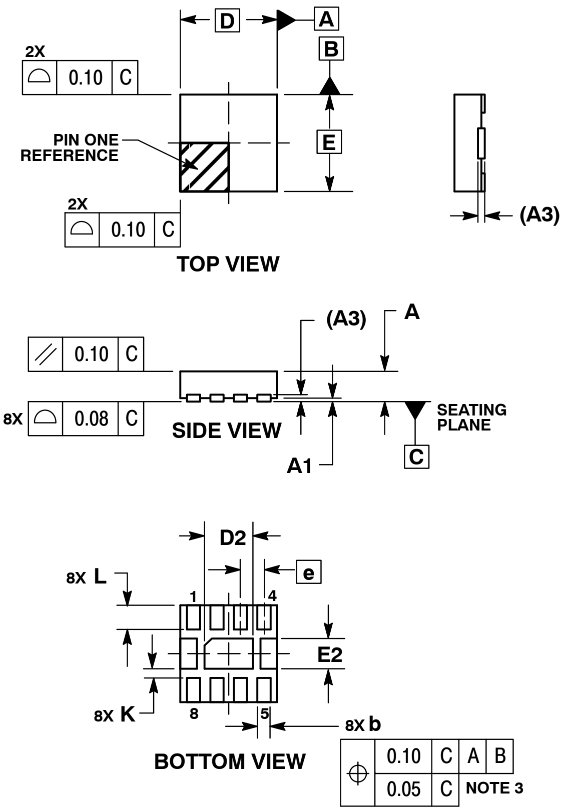
Figure 18. Zero−Crossing Detector



SCALE 4:1

UDFN8, 1.6x1.6, 0.4P
CASE 517AC−01
ISSUE A

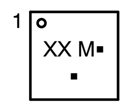
DATE 29 MAR 2006



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 mm FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.
5. EXPOSED PADS CONNECTED TO DIE FLAG. USED AS TEST CONTACTS.

	MILLIMETERS		
DIM	MIN	NOM	MAX
A	0.45	0.50	0.55
A1	0.00	0.03	0.05
A3	0.127 REF		
b	0.15	0.20	0.25
D	1.60 BSC		
D2	0.70	0.80	0.90
E	1.60 BSC		
E2	0.40	0.50	0.60
e	0.40 BSC		
K	0.20	---	---
L	0.20	0.30	0.40

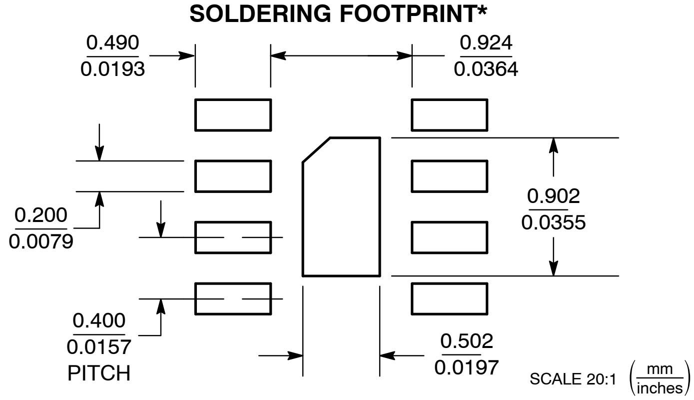
GENERIC MARKING DIAGRAM*



X = Specific Device Code
M = Date Code
▪ = 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.

SOLDERING FOOTPRINT*



*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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DESCRIPTION:	8 PIN UDFN, 1.6X1.6, 0.4P	PAGE 1 OF 1

ADDITIONAL INFORMATION

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