# **TinyLogic UHS Dual Inverter**

# NC7WZ04

#### Description

The NC7WZ04 is a dual inverter from ON Semiconductor's Ultra–High Speed (UHS) series of TinyLogic. The device is fabricated with advanced CMOS technology to achieve ultra–high speed with high output drive while maintaining low static power dissipation over a broad  $V_{CC}$  operating range. The device is specified to operate over a very broad  $V_{CC}$  operating range. The device is specified to operate over the 1.65 V to 5.5 V  $V_{CC}$  range. The inputs tolerate voltages up to 5.5 V independent of  $V_{CC}$  operating voltage.

#### Features

- Ultra-High Speed:  $t_{PD} = 2.3$  ns (Typical) into 50 pF at 5 V V<sub>CC</sub>
- High Output Drive: ±24 mA at 3 V V<sub>CC</sub>
- Broad V<sub>CC</sub> Operating Range: 1.65 V to 5.5 V
- Matches Performance of LCX when Operated at 3.3 V  $V_{CC}$
- Power Down High-Impedance Inputs / Outputs
- Over-Voltage Tolerance Inputs Facilitate 5 V to 3 V Translation
- Proprietary Noise / EMI Reduction Circuitry
- Ultra–Small MicroPak<sup>TM</sup> Packages
- Space-Saving SC-88 6-Lead Package
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

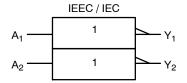
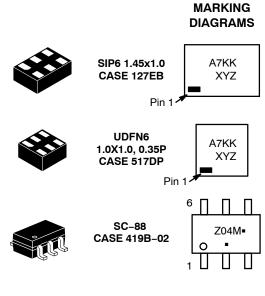


Figure 1. Logic Symbol



# **ON Semiconductor®**

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A7, Z04	= Specific Device Code
KK	= 2-Digit Lot Run Traceability Code
XY	= 2-Digit Date Code Format
Z	= Assembly Plant Code
М	= Date Code*
•	= Pb-Free Package
	Ũ

(Note: Microdot may be in either location)

\*Date Code orientation and/or position may vary depending upon manufacturing location.

#### **ORDERING INFORMATION**

See detailed ordering, marking and shipping information in the package dimensions section on page 6 of this data sheet.

## **Pin Configurations**

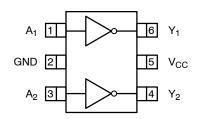
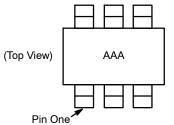


Figure 2. SC-88 (Top View)



NOTES:

- AAA represents product code top mark (see Ordering Information).
  Orientation of top mark determines pin one location.
  Reading the top mark left to right, pin one is the lower left pin.

### Figure 4. SC-88 Pin 1 Orientation

#### **PIN DEFINITIONS**

Pin # SC-88	Pin # MicroPak	Name	Description
1	1	А	Input
2	2	GND	Ground
3	3	А	Input
4	4	Y	Output
5	5	V <sub>CC</sub>	Supply Voltage
6	6	Y	Output

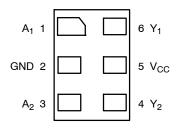


Figure 3. MicroPak (Top Through View)

#### **FUNCTION TABLE**

Input	Output
A	Y
L	Н
Н	L

H = HIGH Logic Level L = LOW Logic Level

#### **ABSOLUTE MAXIMUM RATINGS**

Symbol	Param	Min	Max	Unit	
V <sub>CC</sub>	Supply Voltage	-0.5	6.5	V	
V <sub>IN</sub>	DC Input Voltage		-0.5	6.5	V
V <sub>OUT</sub>	DC Output Voltage		-0.5	6.5	V
I <sub>IK</sub>	DC Input Diode Current	V <sub>IN</sub> < 0 V	-	-50	mA
Ι <sub>ΟΚ</sub>	DC Output Diode Current	V <sub>OUT</sub> < 0 V	-	-50	mA
I <sub>OUT</sub>	DC Output Source / Sink Current	-	±50	mA	
$I_{CC} \text{ or } I_{GND}$	DC V <sub>CC</sub> or Ground Current	-	±50	mA	
T <sub>STG</sub>	Storage Temperature Range	-65	+150	°C	
TJ	Junction Temperature Under Bias	3	-	+150	°C
ΤL	Junction Lead Temperature (Sold	ering, 10 Seconds)	-	+260	°C
PD	Power Dissipation in Still Air	SC-88	-	332	mW
		MicroPak-6	-	812	
		MicroPak2™–6	-	812	
ESD	Human Body Model, JEDEC: JESD22-A114		-	4000	V
	Charge Device Model, JEDEC: JI	ESD22-C101	-	2000	

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

#### **RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter	Conditions	Min	Мах	Unit
V <sub>CC</sub>	Supply Voltage Operating		1.65	5.5	V
	Supply Voltage Data Retention		1.5	5.5	
V <sub>IN</sub>	Input Voltage		0	5.5	V
V <sub>OUT</sub>	Output Voltage		0	V <sub>CC</sub>	V
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall Times	$V_{CC}$ at 1.8 V, 2.5 V $\pm 0.2$ V	0	20	ns/V
		$V_{CC}$ at 3.3 V $\pm 0.3$ V	0	10	
		$V_{CC}$ at 5.0 V $\pm 0.5$ V	0	5	
T <sub>A</sub>	Operating Temperature		-40	+85	°C
$\theta_{JA}$	Thermal Resistance	SC-88	-	377	°C/W
		MicroPak-6	-	154	
		MicroPak2-6	-	154	°C/W

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability. 4. Unused inputs must be held HIGH or LOW. They may not float.

# NC7WZ04

#### DC ELECTICAL CHARACTERISTICS

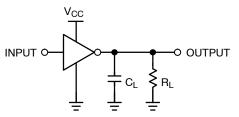
	Parameter			T <sub>A</sub> = +25°C			T <sub>A</sub> = −40 to +85°C		
Symbol		V <sub>CC</sub> (V)	Conditions	Min	Тур	Max	Min	Max	Unit
V <sub>IH</sub>	HIGH Level Input Voltage	1.65 to 1.95		0.65 V <sub>CC</sub>	-	-	0.65 V <sub>CC</sub>	-	V
		2.30 to 5.50		0.70 V <sub>CC</sub>	-	-	0.70 V <sub>CC</sub>	-	1
V <sub>IL</sub>	LOW Level Input Voltage	1.65 to 1.95		-	-	0.35 V <sub>CC</sub>	-	0.35 V <sub>CC</sub>	V
		2.30 to 5.50		-	-	0.30 V <sub>CC</sub>	_	0.30 V <sub>CC</sub>	1
V <sub>OH</sub>	HIGH Level Output Voltage	1.65	$V_{IN} = V_{IH} \text{ or } V_{IL},$	1.55	1.65	-	1.55	_	V
		1.80	I <sub>OH</sub> = -100 μA	1.70	1.80	-	1.70	_	1
		2.30		2.20	2.30	-	2.20	_	1
		3.00		2.90	3.00	-	2.90	_	1
		4.50		4.40	4.50	-	4.40	_	1
		1.65	I <sub>OH</sub> = -4 mA	1.29	1.52	-	1.29	_	1
		2.30	I <sub>OH</sub> = -8 mA	1.90	2.14	-	1.90	_	1
	3.00	I <sub>OH</sub> = -16 mA	2.40	2.75	-	2.40	-	1	
		3.00	I <sub>OH</sub> = -24 mA	2.30	2.62	-	2.30	-	
		4.50	I <sub>OH</sub> = -32 mA	3.80	4.13	-	3.80	-	1
V <sub>OL</sub>	LOW Level Output Voltage	1.65	$V_{IN} = V_{IH} \text{ or } V_{IL},$	_	0.10	0.10	-	0.10	V
		1.80	I <sub>OL</sub> = 100 μA	-	0.00	0.10	-	0.10	
		2.30		-	0.00	0.10	-	0.10	
		3.00		-	0.00	0.10	-	0.10	
		4.50		-	0.00	0.10	-	0.10	
		1.65	I <sub>OL</sub> = 4 mA	-	0.80	0.24	-	0.24	
		2.30	I <sub>OL</sub> = 8 mA	-	0.10	0.30	-	0.30	
		3.00	I <sub>OL</sub> = 16 mA	-	0.16	0.40	-	0.40	
		3.00	I <sub>OL</sub> = 24 mA	-	0.24	0.55	-	0.55	
		4.50	I <sub>OL</sub> = 32 mA	-	0.25	0.55	-	0.55	1
I <sub>IN</sub>	Input Leakage Current	1.65 to 5.5	$0 \leq V_{IN} \leq 5.5 \ V$	-	-	±1	-	±1.0	μA
I <sub>OFF</sub>	Power Off Leakage Current	0	$V_{\text{IN}} \text{ or } V_{\text{OUT}} = 5.5 \text{ V}$	-	-	1	_	10	μA
I <sub>CC</sub>	Quiescent Supply Current	1.65 to 5.50	V <sub>IN</sub> = 5.5 V, GND	-	-	1	-	10	μA

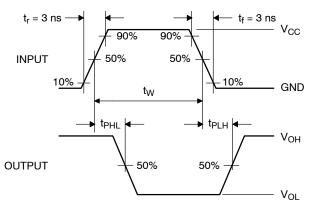
## NC7WZ04

### AC ELECTRICAL CHARACTERISTICS

				T <sub>A</sub> = +25°C		T <sub>A</sub> = -40	to +85°C		
Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	Min	Тур	Max	Min	Мах	Unit
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay	1.65	C <sub>L</sub> = 15 pF,	-	5.3	9.2	-	11.0	ns
	(Figure 5, 6)	1.80	$R_L = 1 M\Omega$	-	4.4	7.6	-	8.4	
		2.50 ±0.20		-	3.0	5.1	-	5.6	
		3.30 ±0.30		-	2.2	3.4	-	3.8	
		5.00 ±0.50		-	1.8	2.8	-	3.1	
		3.30 ±0.30	$C_{L} = 50 \text{ pF},$	-	2.9	4.5	-	5.0	
		5.00 ±0.50	$R_L = 500 \Omega$	-	2.3	3.6	-	4.0	
C <sub>IN</sub>	Input Capacitance	0.00		-	2.5	-	-	-	pF
	Power Dissipation Capacitance	3.30		-	9	-	-	-	pF
	(Note 5) (Figure 7)		1	_	11	-	_	-	

5. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I<sub>CCD</sub>) at no output loading and operating at 50% duty cycle. C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating current by the expression: I<sub>CCD</sub> = (C<sub>PD</sub>) (V<sub>CC</sub>) (f<sub>IN</sub>) + (I<sub>CC</sub>static).



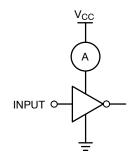


NOTE:

6.  $C_L$  includes load and stray capacitance. 7. Input PRR = 1.0 MHz,  $t_W$  = 500 ns.







NOTE:

- 8. Input = AC Waveform;  $t_r = t_f = 1.8$  ns.
- 9. PRR = Variable; Duty Cycle = 50%.

Figure 7. I<sub>CCD</sub> Test Circuit



### NC7WZ04

#### **DEVICE ORDERING INFORMATION**

Device	Top Mark	Packages	Shipping <sup>†</sup>
NC7WZ04P6X	Z04	6-Lead SC70, EIAJ SC-88, 1.25 mm Wide	3000 / Tape & Reel
NC7WZ04L6X	A7	6-Lead MicroPak, 1.00 mm Wide	5000 / Tape & Reel
NC7WZ04FHX	A7	6-Lead, MicroPak2, 1x1 mm Body, .35 mm Pitch	5000 / Tape & Reel

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

MicroPak and MicroPak2 are trademarks of Semiconductor Components Industries, LLC (SCILLC) or its subsidiaries in the United States and/or other countries.



SIP6 1.45X1.0 CASE 127EB ISSUE O

DATE 31 AUG 2016



0.043

0.004





- XXX = Specific Device Code

(Note: Microdot may be in either location)

\*Date Code orientation and/or position may vary depending upon manufacturing 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.



DIMENSIONS: MILLIMETERS

\*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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#### DATE 11 DEC 2012

STYLE 1: PIN 1. EMITTER 2 2. BASE 2 3. COLLECTOR 1 4. EMITTER 1 5. BASE 1 6. COLLECTOR 2	STYLE 2: CANCELLED	STYLE 3: CANCELLED	STYLE 4: PIN 1. CATHODE 2. CATHODE 3. COLLECTOR 4. EMITTER 5. BASE 6. ANODE	STYLE 5: PIN 1. ANODE 2. ANODE 3. COLLECTOR 4. EMITTER 5. BASE 6. CATHODE	STYLE 6: PIN 1. ANODE 2 2. N/C 3. CATHODE 1 4. ANODE 1 5. N/C 6. CATHODE 2
STYLE 7: PIN 1. SOURCE 2 2. DRAIN 2 3. GATE 1 4. SOURCE 1 5. DRAIN 1 6. GATE 2	STYLE 8: CANCELLED	STYLE 9: PIN 1. EMITTER 2 2. EMITTER 1 3. COLLECTOR 1 4. BASE 1 5. BASE 2 6. COLLECTOR 2	STYLE 10: PIN 1. SOURCE 2 2. SOURCE 1 3. GATE 1 4. DRAIN 1 5. DRAIN 2 6. GATE 2	STYLE 11: PIN 1. CATHODE 2 2. CATHODE 2 3. ANODE 1 4. CATHODE 1 5. CATHODE 1 6. ANODE 2	STYLE 12: PIN 1. ANODE 2 2. ANODE 2 3. CATHODE 1 4. ANODE 1 5. ANODE 1 6. CATHODE 2
STYLE 13:	STYLE 14:	STYLE 15:	STYLE 16:	STYLE 17:	STYLE 18:
PIN 1. ANODE	PIN 1. VREF	PIN 1. ANODE 1	PIN 1. BASE 1	PIN 1. BASE 1	PIN 1. VIN1
2. N/C	2. GND	2. ANODE 2	2. EMITTER 2	2. EMITTER 1	2. VCC
3. COLLECTOR	3. GND	3. ANODE 3	3. COLLECTOR 2	3. COLLECTOR 2	3. VOUT2
4. EMITTER	4. IOUT	4. CATHODE 3	4. BASE 2	4. BASE 2	4. VIN2
5. BASE	5. VEN	5. CATHODE 2	5. EMITTER 1	5. EMITTER 2	5. GND
6. CATHODE	6. VCC	6. CATHODE 1	6. COLLECTOR 1	6. COLLECTOR 1	6. VOUT1
STYLE 19:	STYLE 20:	STYLE 21:	STYLE 22:	STYLE 23:	STYLE 24:
PIN 1. I OUT	PIN 1. COLLECTOR	PIN 1. ANODE 1	PIN 1. D1 (i)	PIN 1. Vn	PIN 1. CATHODE
2. GND	2. COLLECTOR	2. N/C	2. GND	2. CH1	2. ANODE
3. GND	3. BASE	3. ANODE 2	3. D2 (i)	3. Vp	3. CATHODE
4. V CC	4. EMITTER	4. CATHODE 2	4. D2 (c)	4. N/C	4. CATHODE
5. V EN	5. COLLECTOR	5. N/C	5. VBUS	5. CH2	5. CATHODE
6. V REF	6. COLLECTOR	6. CATHODE 1	6. D1 (c)	6. N/C	6. CATHODE
STYLE 25:	STYLE 26:	STYLE 27:	STYLE 28:	STYLE 29:	STYLE 30:
PIN 1. BASE 1	PIN 1. SOURCE 1	PIN 1. BASE 2	PIN 1. DRAIN	PIN 1. ANODE	PIN 1. SOURCE 1
2. CATHODE	2. GATE 1	2. BASE 1	2. DRAIN	2. ANODE	2. DRAIN 2
3. COLLECTOR 2	3. DRAIN 2	3. COLLECTOR 1	3. GATE	3. COLLECTOR	3. DRAIN 2
4. BASE 2	4. SOURCE 2	4. EMITTER 1	4. SOURCE	4. EMITTER	4. SOURCE 2
5. EMITTER	5. GATE 2	5. EMITTER 2	5. DRAIN	5. BASE/ANODE	5. GATE 1
6. COLLECTOR 1	6. DRAIN 1	6. COLLECTOR 2	6. DRAIN	6. CATHODE	6. DRAIN 1

Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.

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