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NC7SZ04
Single Inverter Gate

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General Description

The Operating Voltage Range of the single inverter is 1.65-V to 5.5-V.

The NC7SZ04 device contains one inverter and performs the Boolean function $Y=\overline{A}$. The CMOS device has high output drive while maintaining low static power dissipation over a broad V_{CC} operating range.

This device is fully specified for partial-power-down applications using I_{off}. The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

Features

- **Low Power Consumption, 10-μA Max I_{CC}**
- **Supports 5-V V_{CC} Operation**
- **Inputs Accept Voltages to 5.5 V**
- **Max t_{pd} of 3.3 ns at 3.3 V**
- **±24-mA Output Drive at 3.3 V**
- **I_{off} Supports Partial-Power-Down Mode**
- **Typical V_{OHV} > 2 V at V_{CC} = 3.3 V, T_A = 25°C**
- **Typical V_{OLP} < 0.8 V at V_{CC} = 3.3 V, T_A = 25°C**

Applications

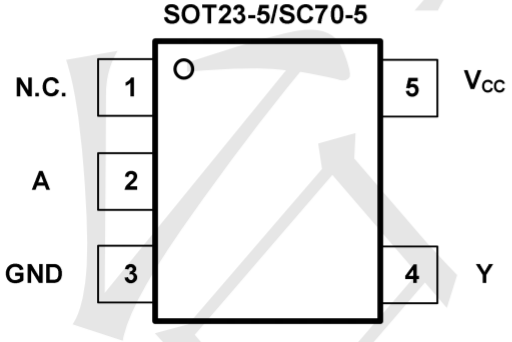
- **AV Receivers**
- **Audio Docks: Portable**
- **Blu-ray Players and Home Theater**
- **Embedded PC**
- **MP3 Player/Recorder (Portable Audio)**
- **Personal Digital Assistant (PDA)**
- **Power: Telecom/Server AC/DC Supply**
- **Solid State Drive (SSD): Client and Enterprise**
- **TV: LCD/Digital and High-Definition (HDTV)**
- **Tablet: Enterprise**
- **Video Analytics: Server**
- **Wireless Headset, Keyboard, and Mouse**

Ordering Information

ORDER NUMBER	PACKAGE DESCRIPTION	PACKAGE OPTION
NC7SZ04M5X	SOT23-5	Tape and Reel,3000
NC7SZ04P5X	SOT353	Tape and Reel,3000

Pin Configuration

SOT23-5/SC70-5

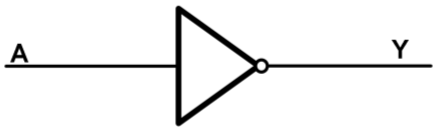


Marking

NC7SZ04M5X Marking:7Z04D

NC7SZ04P5X Marking:Z04C

Logic Diagram



Function Table

INPUT(A)	OUTPUT(Y)
H	L
L	H

Note: H: high voltage level; L: low voltage level.

ESD Ratings

ESD			VALUE	UNIT
V(ESD)	Electrostatic discharge	Human-body model (HBM)	4K	V
		Charge device model (CDM)	2K	V

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

SYMBOL	PARAMETER		MIN	MAX	UNIT
V_{CC}	Supply voltage		1.65	5.5	V
V_I	Input voltage		0	5.5	V
V_O	Output voltage		0	V_{CC}	V
I_{OH}	High-level output current	V_{CC}=1.65V		-4	mA
		V_{CC}=2.3V		-8	
		V_{CC}=3V		-16	
				-24	
		V_{CC}=4.5V		-32	
I_{OL}	Low-level output current	V_{CC}=1.65V		4	mA
		V_{CC}=2.3V		8	
		V_{CC}=3V		16	
				24	
		V_{CC}=4.5V		32	
T_A	Operating free-air temperature		-40	125	℃

Electrical Characteristics

Vcc=5.0V or 3.3V, FULL=–40°C to +125°C, Typical values are at TA = +25°C. (unless otherwise noted)

PARAMETER	TEST CONDITIONS	VCC	–40°C to 85°C			–40°C to 125°C			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{OH}	I_{OH} = – 100 µA	1.65 V to 5.5 V	V_{CC}-0.1			V_{CC}-0.1			V
	I_{OH} = –4 mA	1.65 V	1.2			1.2			
	I_{OH} = –8 mA	2.3 V	1.9			1.9			
	I_{OH} = – 16 mA	3 V	2.4			2.4			
	I_{OH} = –24 mA		2.3			2.3			
	I_{OH} = –32 mA	4.5 V	3.8			3.8			
V_{OL}	I_{OL} = 100 µA	1.65 V to 5.5 V			0.1			0.1	V
	I_{OL} = 4 mA	1.65 V			0.45			0.45	
	I_{OL} = 8 mA	2.3 V			0.3			0.3	
	I_{OL} = 16 mA	3 V			0.4			0.4	
	I_{OL} = 24 mA				0.55			0.55	
	I_{OL} = 32 mA	4.5 V			0.55			0.55	
I_I A input	V_I = 5.5 V or GND	0 to 5.5 V			±5			±5	µA
I_{off}	V_I or V_O = 5.5 V	0			±10			±10	µA
I_{CC}	V_I = 5.5 V or GND, I_O = 0	1.65 V to 5.5 V			10			10	µA
ΔI_{CC}	One input at V_{CC} – 0.6 V, Other inputs at V_{CC} or GND	3 V to 5.5 V			500			500	µA
C_i	V_I = V_{CC} or GND	3.3 V		5			5		pF

Electrical specifications(continued)

Vcc=5.0V or 3.3V, FULL=–40°C to +125°C, Typical values are at TA = +25°C. (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	–40°C to 125°C								UNIT
			V_{CC} = 1.8 V ± 0.15 V		V_{CC} = 2.5 V ± 0.2 V		V_{CC} = 3.3 V ± 0.3 V		V_{CC} = 5 V ± 0.5 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A	Y	3.9	8.0	1.4	3.5	1	3.3	1	3.0	ns

T_A=25°C

	PARAMETER	TEST CONDITIONS	V_{CC} = 1.8 V	V_{CC} = 2.5 V	V_{CC} = 3.3 V	V_{CC} = 5 V	UNIT
			TYP	TYP	TYP	TYP	
C_{pd}	Power dissipation capacitance	f = 10 MHz	17	18	25	30	pF

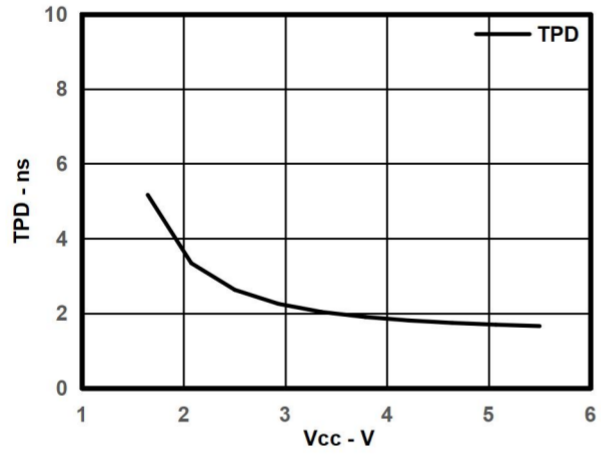


Figure 1. Typical Tpd vs Vcc

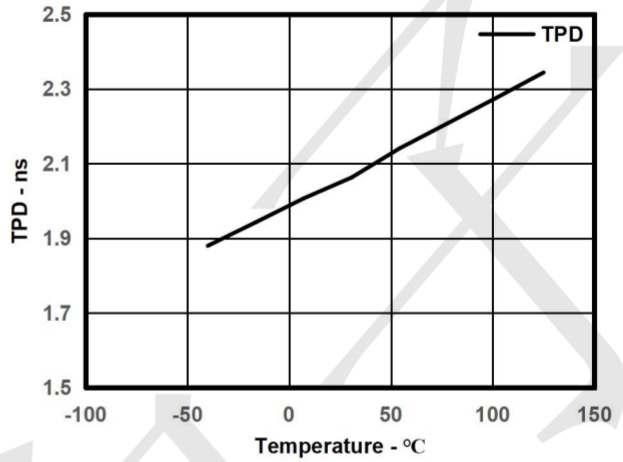


Figure 2. Typical Tpd vs Temp

Detailed Description

1 Overview

This device is fully specified for partial-power-down applications using I_{off}. The I_{off} circuitry disables the outputs, preventing damaging current back flow through the device when it is powered down.

2 Functional Block Diagram

3 Feature Description

The device is designed for 1.65V to 5.5V VCC operation and it allows down voltage translation from 5V to 3.3V, or 3.3V to 1.8V. Input signals to this device can be driven above the supply voltage so long as they remain below the maximum input voltage value. I_{off} feature allows voltages on the inputs and outputs, when VCC is 0 V.

4 Device Functional Modes

Table 9-1 Function Table

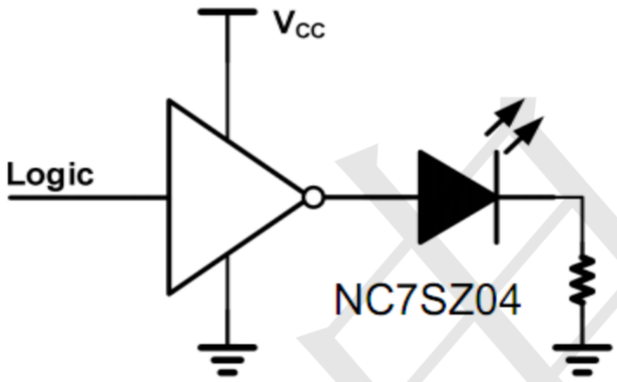
INPUT A	OUTPUT Y
H	L
L	H

Application note

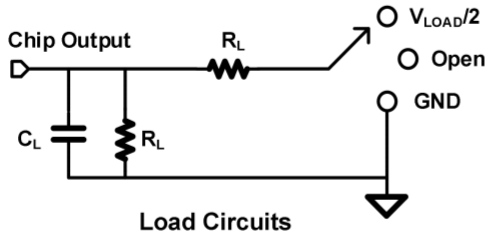
1 Application Information

The NC7SZ04 is a high drive CMOS device that can be used for implementing inversion logic with a high output drive, such as an LED application. It can produce 24 mA of drive current at 3.3 V making it Ideal for driving multiple outputs and good for high-speed applications up to 100 Mhz. The inputs are 5.5 V tolerant allowing it to translate down to VCC.

2 Typical Application



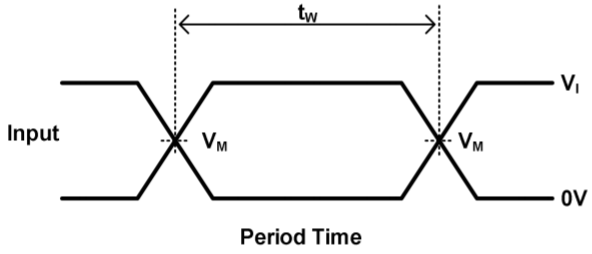
Parameter Measurement Information



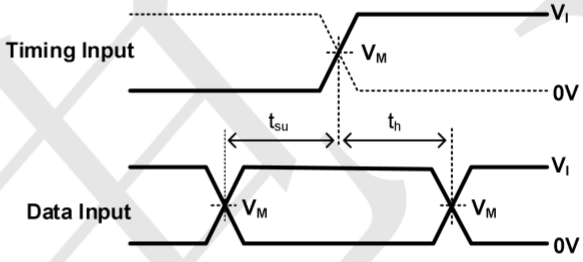
Load Circuits

TEST	S1
T_{PHL}/T_{PLH}	OPEN
T_{PLZ}/T_{PZL}	V_{LOAD}
T_{PHZ}/T_{PZH}	GND

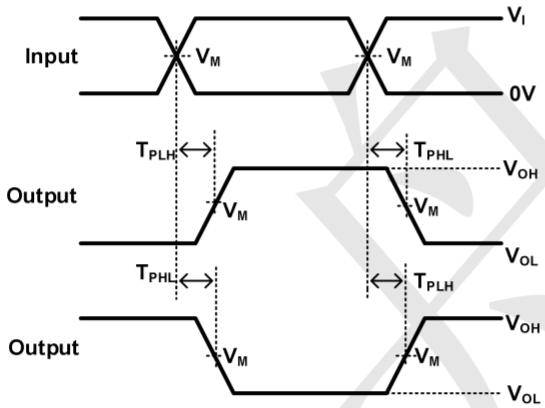
V_{CC}	INPUTS		V_M	V_{LAOD}	C_L	R_L	V_Δ
	V_I	T_r/T_f					
1.8V±0.15V	V_{CC}	≤2ns	$V_{CC}/2$	$2\times V_{CC}$	30pF	1kΩ	0.15V
2.5V±0.15V	V_{CC}	≤2ns	$V_{CC}/2$	$2\times V_{CC}$	30pF	500Ω	0.15V
3.3V±0.15V	3V	≤2.5ns	1.5V	6V	50pF	500Ω	0.3V
5V±0.15V	V_{CC}	≤2.5ns	$V_{CC}/2$	$2\times V_{CC}$	50pF	500Ω	0.3V



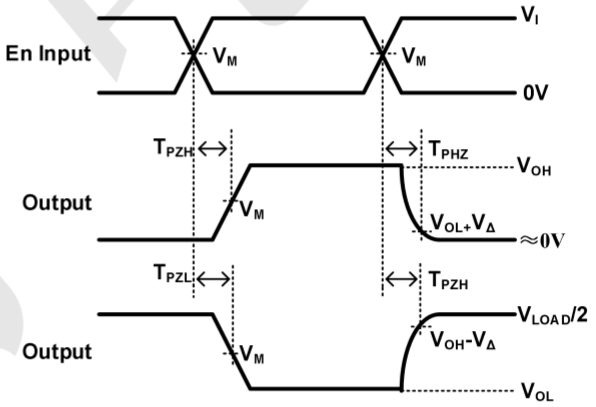
Period Time



Setup and Hold Times



Propagation Delay
for Output and Inverted Output

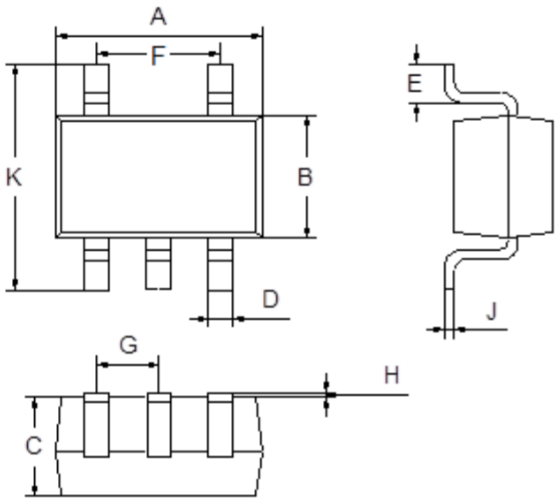


Enable and Disable Times
Low-And High-Level Enabling

Notes: A. C includes probe and jig capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
C. All input pulses are supplied by generators having the following characteristics: PRR 10 MHz, Z =50.
D. The outputs are measured one at a time, with one transition per measurement.
E. t_{PLZ} and t_{PHZ} are the same as t_{dis}.
F. t_{PZL} and t_{PZH} are the same as t_{en}.
G. t_{PLH} and t_{PHL} are the same as t_{pd}.
H. All parameters and waveforms are not applicable to all device.

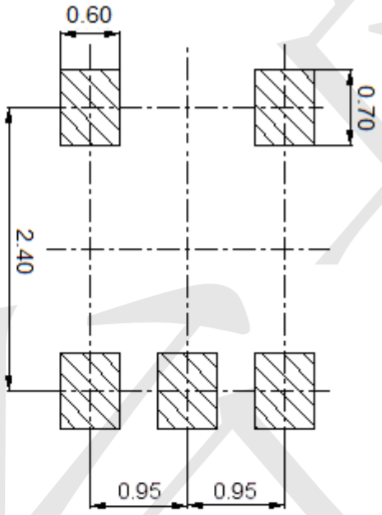
Package Outline Dimensions (Unit: mm)

SOT23-5



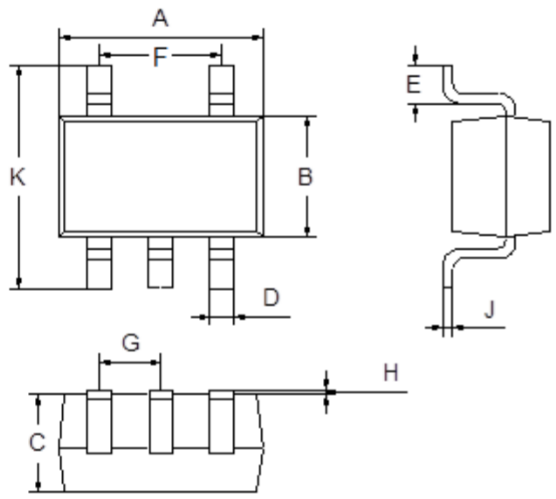
Dimension	Min.	Max.
A	2.80	3.00
B	1.50	1.70
C	1.00	1.20
D	0.35	0.45
E	0.35	0.55
F	1.80	2.00
G	0.90	1.00
H	0.02	0.10
J	0.10	0.20
K	2.60	3.00

Mounting Pad Layout (Unit: mm)



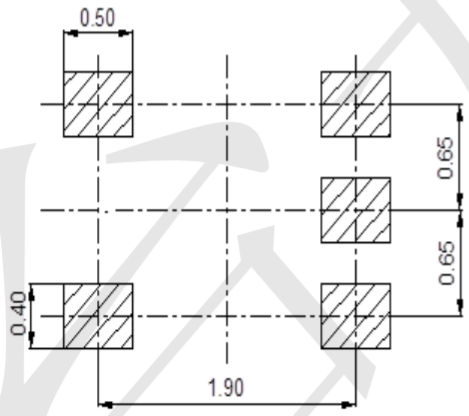
Package Outline Dimensions (Unit: mm)

SOT353



Dimension	Min.	Max.
A	2.00	2.20
B	1.15	1.35
C	0.85	1.05
D	0.15	0.35
E	0.25	0.40
F	1.20	1.40
G	0.60	0.70
H	0.02	0.10
J	0.05	0.15
K	2.20	2.40

Mounting Pad Layout (Unit: mm)



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