

Data sheet acquired from Harris Semiconductor SCHS131C

August 1997 - Revised September 2003

Features

- Buffered Inputs
- Typical Propagation Delay: 9ns at V_{CC} = 5V, C_L = 15pF, T_A = 25° C
- Fanout (Over Temperature Range)
 - Standard Outputs..... 10 LSTTL Loads
 - Bus Driver Outputs 15 LSTTL Loads
- Wide Operating Temperature Range ... -55°C to 125°C
- Balanced Propagation Delay and Transition Times
- Significant Power Reduction Compared to LSTTL Logic ICs
- HC Types
 - 2V to 6V Operation
 - High Noise Immunity: N_{IL} = 30%, N_{IH} = 30% of V_{CC} at V_{CC} = 5V
- HCT Types
 - 4.5V to 5.5V Operation
 - Direct LSTTL Input Logic Compatibility, V_{IL}= 0.8V (Max), V_{IH} = 2V (Min)
 - CMOS Input Compatibility, II \leq 1µA at VOL, VOH

CD54HC21, CD74HC21, CD74HCT21

High-Speed CMOS Logic Dual 4-Input AND Gate

Description

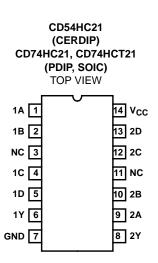
The 'HC21 and CD74HCT21 logic gates utilize silicon gate CMOS technology to achieve operating speeds similar to LSTTL gates with the low power consumption of standard CMOS integrated circuits. All devices have the ability to drive 10 LSTTL loads. The HCT logic family is functionally pin compatible with the standard LS logic family.

Ordering Information

PART NUMBER	TEMP. RANGE (^o C)	PACKAGE
CD54HC21F3A	-55 to 125	14 Ld CERDIP
CD74HC21E	-55 to 125	14 Ld PDIP
CD74HC21M	-55 to 125	14 Ld SOIC
CD74HC21MT	-55 to 125	14 Ld SOIC
CD74HC21M96	-55 to 125	14 Ld SOIC
CD74HCT21E	-55 to 125	14 Ld PDIP
CD74HCT21M	-55 to 125	14 Ld SOIC
CD74HCT21MT	-55 to 125	14 Ld SOIC
CD74HCT21M96	-55 to 125	14 Ld SOIC

NOTE: When ordering, use the entire part number. The suffix 96 denotes tape and reel. The suffix T denotes a small-quantity reel of 250.

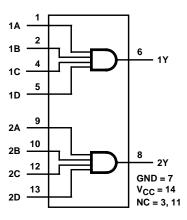
Pinout



CAUTION: These devices are sensitive to electrostatic discharge. Users should follow proper IC Handling Procedures.

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Functional Diagram

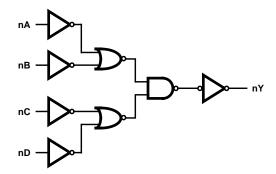


TRUTH TABLE

	INP	UTS		OUTPUT
nA	nB	nC	nD	nY
L	Х	Х	Х	L
Х	L	х	Х	L
Х	Х	L	Х	L
Х	Х	х	L	L
Н	Н	Н	Н	Н

H = High Voltage Level, L = Low Voltage Level, X = Irrelevant

Logic Symbol



Absolute Maximum Ratings

DC Supply Voltage, V _{CC} 0.5V to 7V
DC Input Diode Current, I _{IK}
For V _I < -0.5V or V _I > V _{CC} + 0.5V±20mA
DC Output Diode Current, I _{OK}
For $V_0 < -0.5V$ or $V_0 > V_{CC} + 0.5V$
DC Output Source or Sink Current per Output Pin, IO
For $V_{O} > -0.5V$ or $V_{O} < V_{CC} + 0.5V$ ±25mA
DC V _{CC} or Ground Current, I _{CC or} I _{GND} ±50mA
Operating Conditions

Operating Conditions

Temperature Range (T _A)
Supply Voltage Range, V _{CC}
HC Types
HCT Types4.5V to 5.5V
DC Input or Output Voltage, V _I , V _O 0V to V _{CC}
Input Rise and Fall Time
2V
4.5V 500ns (Max)
6V

Thermal Information

Thermal Resistance (Typical, Note 1)	θ _{JA} (^o C/W)
E (PDIP) Package	. 80
M (SOIC) Package	
Maximum Junction Temperature	150 ⁰ C
Maximum Storage Temperature Range	-65 ⁰ C to 150 ⁰ C
Maximum Lead Temperature (Soldering 10s)	
(SOIC - Lead Tips Only)	

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:

1. The package thermal impedance is calculated in accordance with JESD 51-7.

DC Electrical Specifications

		TE COND	ST ITIONS		25 ⁰ C			-40 ⁰ C 1	O 85 ⁰ C	-55°C TO 125°C		
PARAMETER	SYMBOL	V _I (V)	I _O (mA)	V _{CC} (V)	MIN	TYP	MAX	MIN	MAX	MIN	MAX	UNITS
HC TYPES	-								-		-	-
High Level Input	VIH	-	-	2	1.5	-	-	1.5	-	1.5	-	V
Voltage				4.5	3.15	-	-	3.15	-	3.15	-	V
				6	4.2	-	-	4.2	-	4.2	-	V
Low Level Input	V _{IL}	-	-	2	-	-	0.5	-	0.5	-	0.5	V
Voltage				4.5	-	-	1.35	-	1.35	-	1.35	V
				6	-	-	1.8	-	1.8	-	1.8	V
High Level Output	V _{OH}	V _{IH} or	-0.02	2	1.9	-	-	1.9	-	1.9	-	V
Voltage CMOS Loads		VIL	-0.02	4.5	4.4	-	-	4.4	-	4.4	-	V
			-0.02	6	5.9	-	-	5.9	-	5.9	-	V
High Level Output	1		-	-	-	-	-	-	-	-	-	V
Voltage TTL Loads			-4	4.5	3.98	-	-	3.84	-	3.7	-	V
			-5.2	6	5.48	-	-	5.34	-	5.2	-	V
Low Level Output	V _{OL}	V _{IH} or	0.02	2	-	-	0.1	-	0.1	-	0.1	V
Voltage CMOS Loads		VIL	0.02	4.5	-	-	0.1	-	0.1	-	0.1	V
			0.02	6	-	-	0.1	-	0.1	-	0.1	V
Low Level Output	1		-	-	-	-	-	-	-	-	-	V
Voltage TTL Loads			4	4.5	-	-	0.26	-	0.33	-	0.4	V
			5.2	6	-	-	0.26	-	0.33	-	0.4	V
Input Leakage Current	Ц	V _{CC} or GND	-	6	-	-	±0.1	-	±1	-	±1	μA

			ST ITIONS		25 ⁰ C			-40 ^o C 1	ГО 85 ⁰ С	-55°C T	O 125 ⁰ C	
PARAMETER	SYMBOL	V _I (V)	I _O (mA)	V _{CC} (V)	MIN	ТҮР	MAX	MIN	MAX	MIN	MAX	UNITS
Quiescent Device Current	Icc	V _{CC} or GND	0	6	-	-	2	-	20	-	40	μA
HCT TYPES												
High Level Input Voltage	VIH	-	-	4.5 to 5.5	2	-	-	2	-	2	-	V
Low Level Input Voltage	VIL	-	-	4.5 to 5.5	-	-	0.8	-	0.8	-	0.8	V
High Level Output Voltage CMOS Loads	V _{OH}	V _{IH} or V _{IL}	-0.02	4.5	4.4	-	-	4.4	-	4.4	-	V
High Level Output Voltage TTL Loads			-4	4.5	3.98	-	-	3.84	-	3.7	-	V
Low Level Output Voltage CMOS Loads	V _{OL}	V _{IH} or V _{IL}	0.02	4.5	-	-	0.1	-	0.1	-	0.1	V
Low Level Output Voltage TTL Loads			4	4.5	-	-	0.26	-	0.33	-	0.4	V
Input Leakage Current	lı	V _{CC} and GND	0	5.5	-		±0.1	-	±1	-	±1	μA
Quiescent Device Current	Icc	V _{CC} or GND	0	5.5	-	-	2	-	20	-	40	μA
Additional Quiescent Device Current Per Input Pin: 1 Unit Load	ΔI _{CC} (Note 2)	V _{CC} -2.1	-	4.5 to 5.5	-	100	360	-	450	-	490	μA

NOTE:

2. For dual-supply systems theoretical worst case (V_I = 2.4V, V_{CC} = 5.5V) specification is 1.8mA.

HCT Input Loading Table

INPUT	UNIT LOADS
All	1

NOTE: Unit Load is ΔI_{CC} limit specified in DC Electrical Specifications table, e.g. $360\mu A$ max at $25^{\circ}C$.

Switching Specifications Input t_r , $t_f = 6ns$

		TEST	sт v _{cc}		25 ⁰ C			-40°C TO 85°C		-55°C TO 125°C	
PARAMETER	SYMBOL	CONDITIONS	(V)	MIN	ΤΥΡ	MAX	MIN	MAX	MIN	MAX	UNITS
HC TYPES											
Propagation Delay, Input to	t _{PLH} , t _{PHL}	C _L = 50pF	2	-	-	110	-	140	-	165	ns
Output (Figure 1)			4.5	-	-	22	-	28	-	33	ns
			6	-	-	19	-	24	-	28	ns
Propagation Delay, Data Input to Output Y	t _{PLH} , t _{PHL}	C _L = 15pF	5	-	9	-	-	-	-	-	ns

CD54HC21, CD74HC21, CD74HCT21

		TEST	v _{cc}		25 ⁰ C		-40 ⁰ C T	О 85 ⁰ С	-55°C TO 125°C		
PARAMETER	SYMBOL	CONDITIONS	(V)	MIN	ТҮР	MAX	MIN	MAX	MIN	MAX	UNITS
Transition Times (Figure 1)	t _{TLH} , t _{THL}	C _L = 50pF	2	-	-	75	-	95	-	110	ns
			4.5	-	-	15	-	19	-	22	ns
			6	-	-	13	-	16	-	19	ns
Input Capacitance	CI	-	-	-	-	10	-	10	-	10	pF
Power Dissipation Capacitance (Notes 3, 4)	C _{PD}	-	5	-	36	-	-	-	-	-	pF
HCT TYPES											
Propagation Delay, Input to Output (Figure 2)	t _{RHL} , t _{PHL}	C _L = 50pF	4.5	-	-	27	-	34	-	41	ns
Propagation Delay, Data Input to Output Y	t _{PLH} , t _{PHL}	C _L = 15pF	5	-	11	-	-	-	-	-	ns
Transition Times (Figure 2)	t _{TLH} , t _{THL}	C _L = 50pF	4.5	-	-	15	-	19	-	22	ns
Input Capacitance	CI	-	-	-	-	10	-	10	-	10	pF
Power Dissipation Capacitance (Notes 3, 4)	C _{PD}	-	5	-	42	-	-	-	-	-	pF

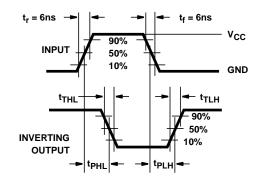
Switching Specifications Input t_r, t_f = 6ns (Continued)

NOTES:

3. C_{PD} is used to determine the dynamic power consumption, per gate.

4. $P_D = V_{CC}^2 f_i (C_{PD} + C_L)$ where f_i = input frequency, C_L = output load capacitance, V_{CC} = supply voltage.

Test Circuits and Waveforms





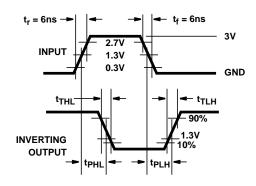


FIGURE 2. HCT TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC



24-Aug-2014

PACKAGING INFORMATION

Orderable Device	Status	Package Type	Package	Pins	Package	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Op Temp (°C)	Device Marking	Samples
	(1)		Drawing		Qty	(2)	(6)	(3)		(4/5)	
CD54HC21F3A	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8857601CA CD54HC21F3A	Samples
CD74HC21E	ACTIVE	PDIP	Ν	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-55 to 125	CD74HC21E	Samples
CD74HC21EE4	ACTIVE	PDIP	Ν	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-55 to 125	CD74HC21E	Samples
CD74HC21M	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC21M	Samples
CD74HC21M96	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC21M	Samples
CD74HC21M96G4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC21M	Samples
CD74HC21MG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC21M	Samples
CD74HCT21E	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-55 to 125	CD74HCT21E	Samples
CD74HCT21EE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-55 to 125	CD74HCT21E	Samples
CD74HCT21M	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	HCT21M	Samples
CD74HCT21M96	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	HCT21M	Samples
CD74HCT21ME4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	HCT21M	Samples
CD74HCT21MG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	HCT21M	Samples
CD74HCT21MT	ACTIVE	SOIC	D	14	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	HCT21M	Samples

⁽¹⁾ The marketing status values are defined as follows: **ACTIVE:** Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.



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(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

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Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

⁽⁴⁾ There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(⁵⁾ Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

⁽⁶⁾ Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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OTHER QUALIFIED VERSIONS OF CD54HC21, CD74HC21 :

Catalog: CD74HC21

Military: CD54HC21

NOTE: Qualified Version Definitions:

Catalog - TI's standard catalog product



PACKAGE OPTION ADDENDUM

24-Aug-2014

Military - QML certified for Military and Defense Applications

PACKAGE MATERIALS INFORMATION

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TAPE AND REEL INFORMATION





QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*/	*All dimensions are nominal												
	Device	Package Type	Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
	CD74HC21M96	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
	CD74HCT21M96	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
Γ	CD74HCT21MT	SOIC	D	14	250	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1

TEXAS INSTRUMENTS

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PACKAGE MATERIALS INFORMATION

18-Aug-2014



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CD74HC21M96	SOIC	D	14	2500	367.0	367.0	38.0
CD74HCT21M96	SOIC	D	14	2500	367.0	367.0	38.0
CD74HCT21MT	SOIC	D	14	250	367.0	367.0	38.0

J (R-GDIP-T**) 14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



NOTES: A. All linear dimensions are in inches (millimeters).

- B. This drawing is subject to change without notice.
- C. This package is hermetically sealed with a ceramic lid using glass frit.
- D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
- E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



NOTES:

- A. All linear dimensions are in inches (millimeters).B. This drawing is subject to change without notice.
- Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
- \triangle The 20 pin end lead shoulder width is a vendor option, either half or full width.



D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



NOTES: A. All linear dimensions are in inches (millimeters).

- B. This drawing is subject to change without notice.
- Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
- Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
- E. Reference JEDEC MS-012 variation AB.





NOTES: A. All linear dimensions are in millimeters.

- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate designs.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



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