To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

Send any inquiries to http://www.renesas.com/inquiry.

Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
7. Renesas Electronics products are classified according to the following three quality grades: "Standard", "High Quality", and "Specific". The recommended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as "Specific" without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as "Specific" or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is "Standard" unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.

   "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots.

   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; safety equipment; and medical equipment not specifically designed for life support.

   "Specific": Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.
8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

HD74AC283/HD74ACT283

4-bit Binary Full Adder with Fast Carry

REJ03D0267–0200Z
(Previous ADE-205-388 (Z))
Rev.2.00
Jul.16.2004

Description

The HD74AC283/HD74ACT283 high-speed 4-bit binary full adder with internal carry lookahead accepts two 4-bit binary works ($A_0 – A_3$, $B_0 – B_3$) and a Carry input (C_0). It generates the binary Sum outputs ($S_0 – S_3$) and the Carry output (C_4) from the most significant bit. The HD74AC283/HD74ACT283 will operate with either active High or active Low operands (positive or negative logic).

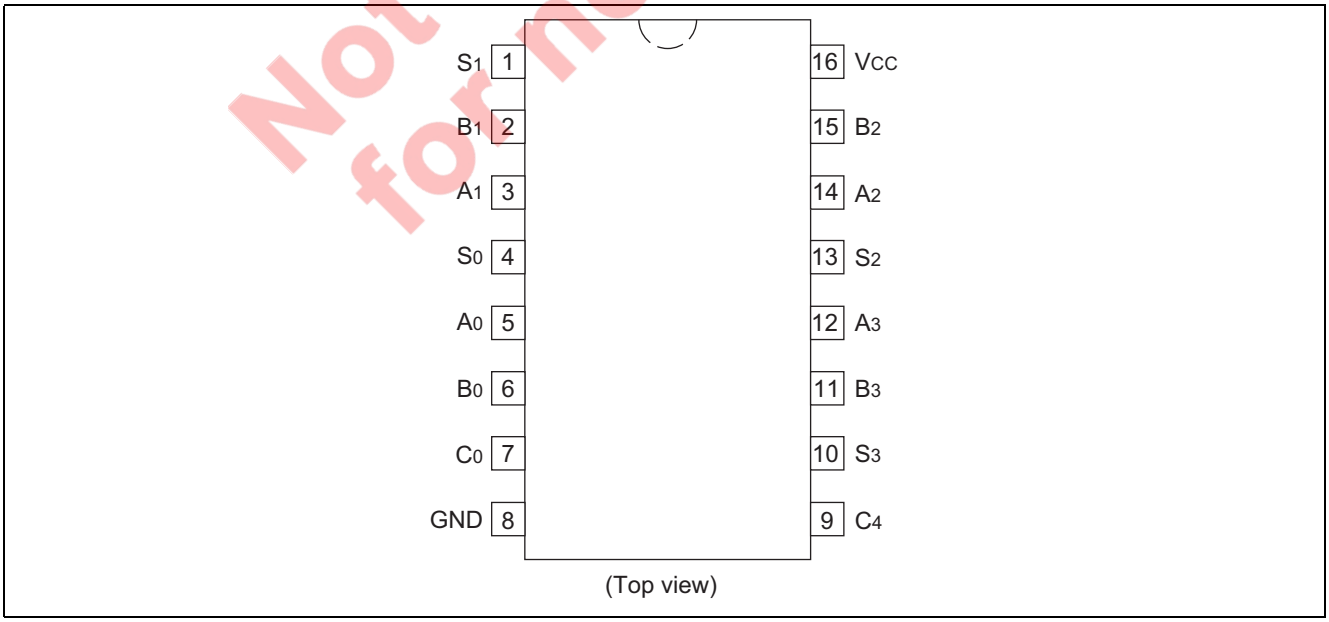
Features

- Outputs Source/Sink 24 mA
- HD74ACT283 has TTL-Cmpatible Inputs
- Ordering Information: Ex. HD74AC283

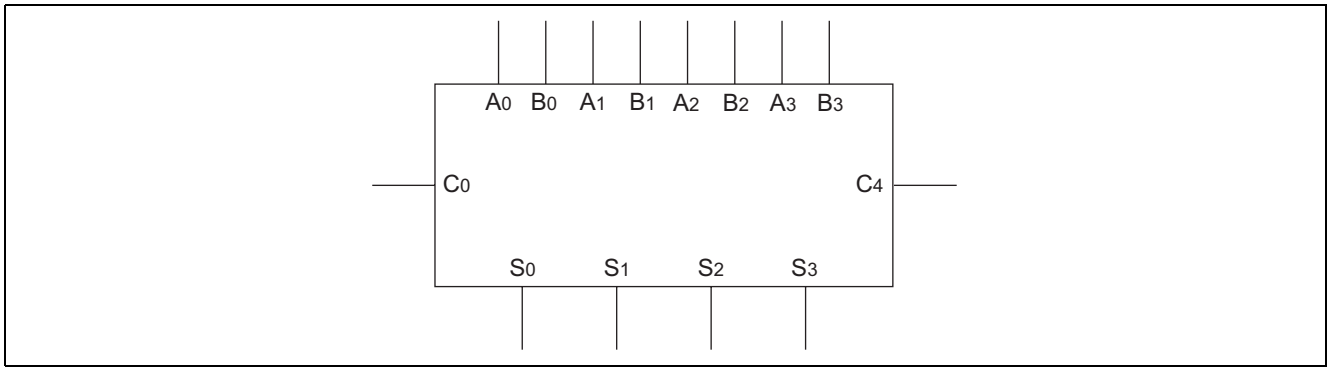
Part Name	Package Type	Package Code	Package Abbreviation	Taping Abbreviation (Quantity)
HD74AC283AP	DIP-16 pin	DP-16E, -16FV	P	—
HD74AC283AFPEL	SOP-16 pin (JEITA)	FP-16DAV	FP	EL (2,000 pcs/reel)
HD74AC283ARPEL	SOP-16 pin (JEDEC)	FP-16DNV	RP	EL (2,500 pcs/reel)
HD74AC283TELL	TSSOP-16 pin	TTP-16DAV	T	ELL(2,000 pcs/reel)

Notes: 1. Please consult the sales office for the above package availability.
2. The packages with lead-free pins are distinguished from the conventional products by adding V at the end of the package code.

Pin Arrangement



Logic Symbol



Pin Names

$A_0 – A_3$	A Operand Inputs
$B_0 – B_3$	B Operand Inputs
C_0	Carry Input
$S_0 – S_3$	Sum Outputs
C_4	Carry Output

Functional Description

The HD74AC283/HD74ACT283 adds two 4-bit binary words (A plus B) plus the incoming Carry (C_0). The binary sum appears on the Sum ($S_0 – S_3$) and outgoing carry (C_4) outputs. The binary weight of the various inputs and outputs is indicated by the subscript numbers, representing powers of two.

$2^0 (A_0 + B_0 + C_0) + 2^1 (A_1 + B_1) + 2^2 (A_2 + B_2) + 2^3 (A_3 + B_3) = S_0 + 2S_1 + 4S_2 + 8S_3 + 16C_4$

Where (+) = plus

Interchanging inputs of equal weight does not affect the operation. Thus C_0, A_0, B_0 can be arbitrarily assigned to pins 5, 6 and 7 for DIPS. Due to the symmetry of the binary add function, the HD74AC283/HD74ACT283 can be used either with all inputs and outputs active High (positive logic) or with all inputs and outputs active Low (negative logic). See Figure a. Note that if C_0 is not used it must be tied Low for active High logic or tied High for active Low logic.

Due to pin limitations, the intermediate carries of the HD74AC283/HD74ACT283 are not brought out for use as inputs or outputs. However, other means can be used to effectively insert a carry into, or bring a carry out from, an intermediate stage. Figure b shows how to make a 3-bit adder. Tying the operand inputs of the fourth adder (A_3, B_3) Low makes S_3 dependent only on, and equal to, the carry from the third adder. Using somewhat the same principle Figure c shows a way of dividing the HD74AC283/HD74ACT283 into a 2-bit and a 1-bit adder. The third stage adder (A_2, B_2, S_2) is used merely as a means of getting a carry (C_{10}) signal into the fourth stage (via A_2 and B_2) and bringing out the carry from the second stage on S_2. Note that as long as A_2 and B_2 are the same, whether High or Low, they do not influence S_2. Similarly, when A_2 and B_2 are the same the carry into the third stage does not influence the carry out of the third stage. Figure d shows a method of implementing a 5-input encoder, where the inputs are equally weighted. The outputs S_0, S_1 and S_2 present a binary number equal to the number of inputs $I_1 – I_5$ that are true. Figure e shows one method of implementing a 5-input majority gate. When three or more of the inputs $I_1 – I_5$ are true, the output M_5 is true.

Fig. a Active HIGH varsus Active LOW Interpretation

	C_0	A_0	A_1	A_2	A_3	B_0	B_1	B_2	B_3	S_0	S_1	S_2	S_3	C_4
Logic levels	L	L	H	L	H	H	L	L	H	H	H	L	L	H
Active HIGH	0	0	1	0	1	1	0	0	1	1	1	0	0	1
Active LOW	1	1	0	1	0	0	1	1	0	0	0	1	1	0

Active HIGH: 0 + 10 + 9 = 3 + 16

Active LOW: 1 + 5 + 6 = 12 + 0

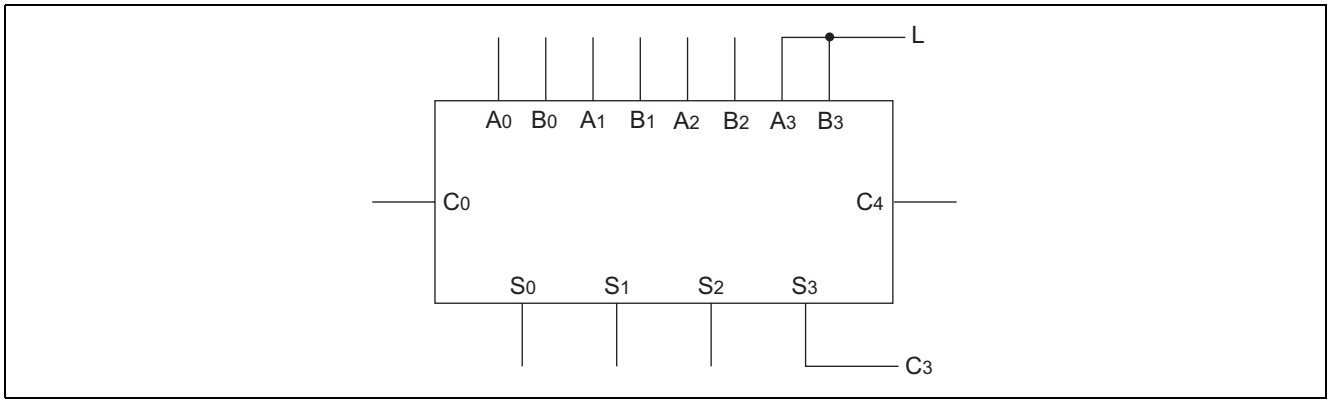


Fig. b 3-bit Adder

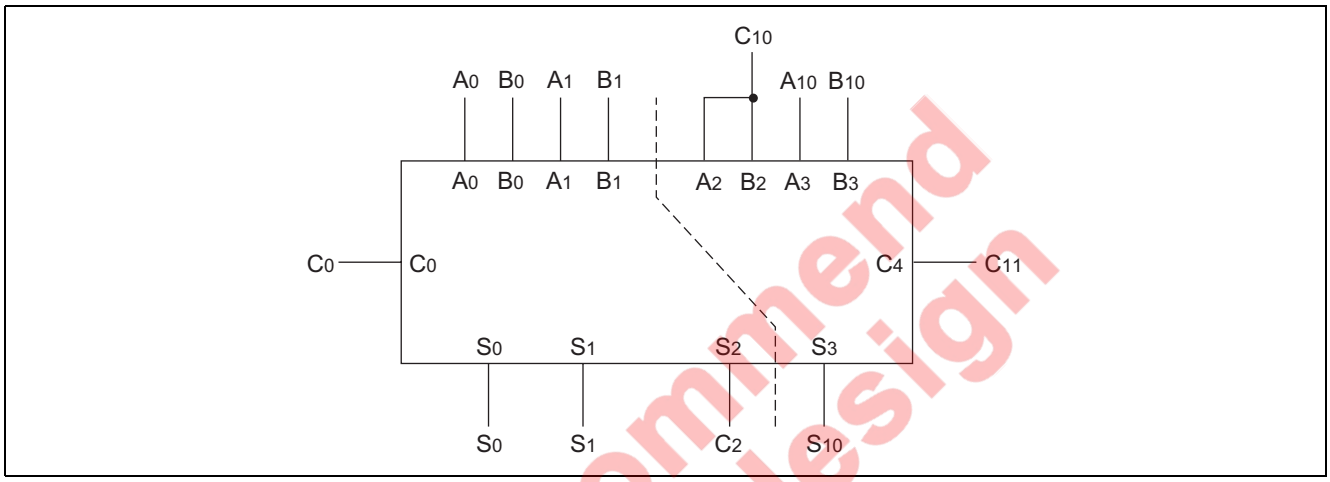


Fig. c 2-bit and 1-bit adders

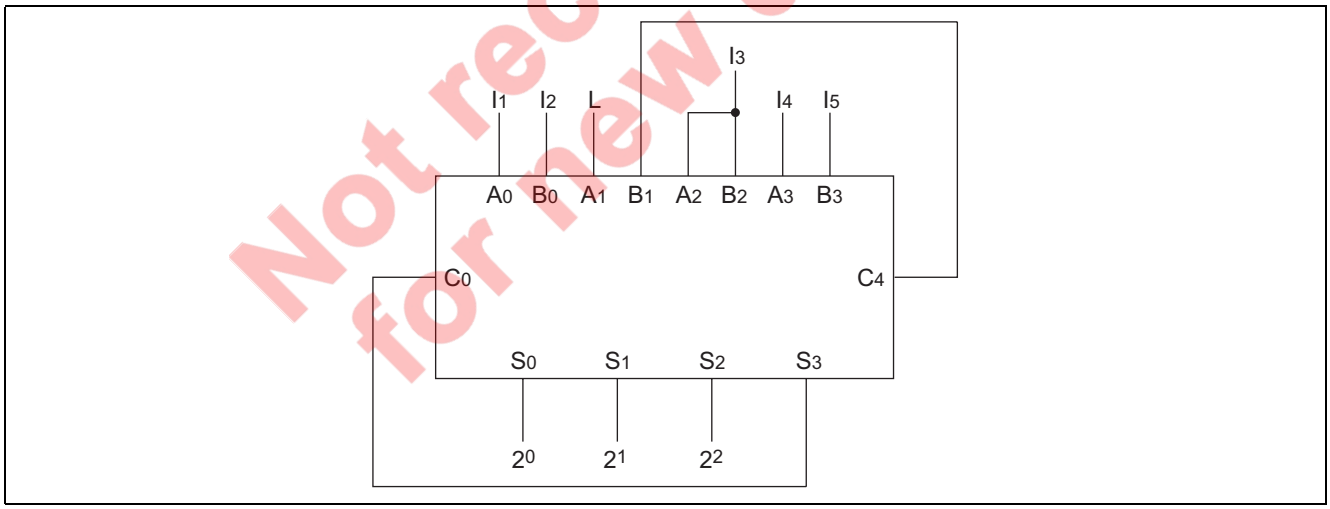


Fig. d 5-Input Encoder

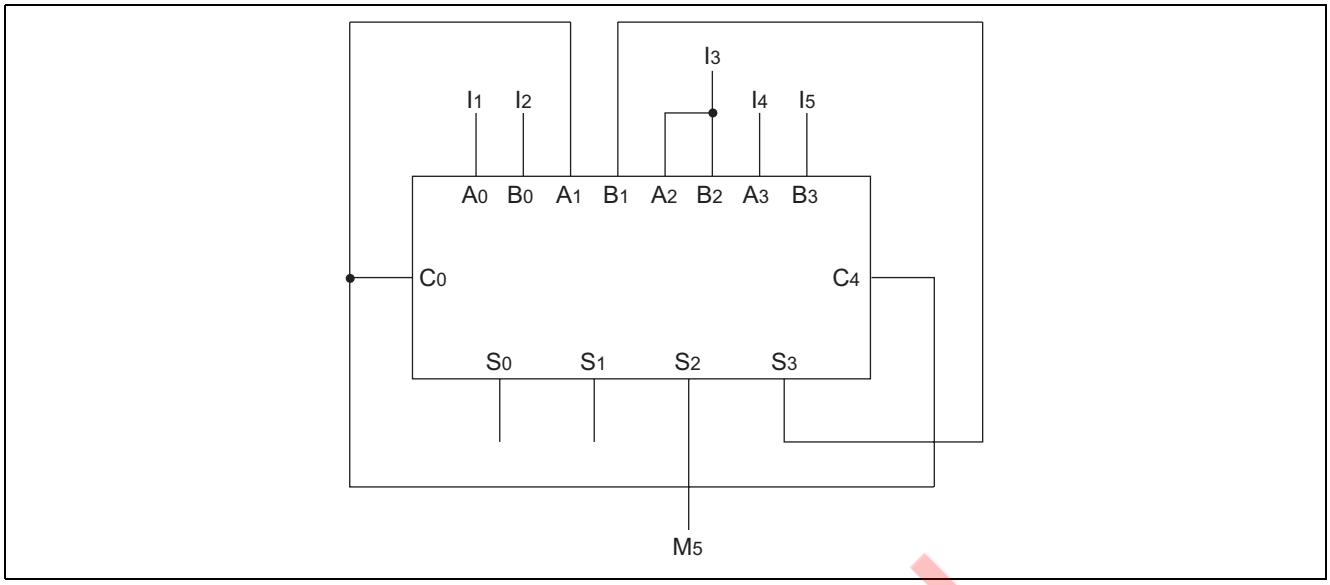
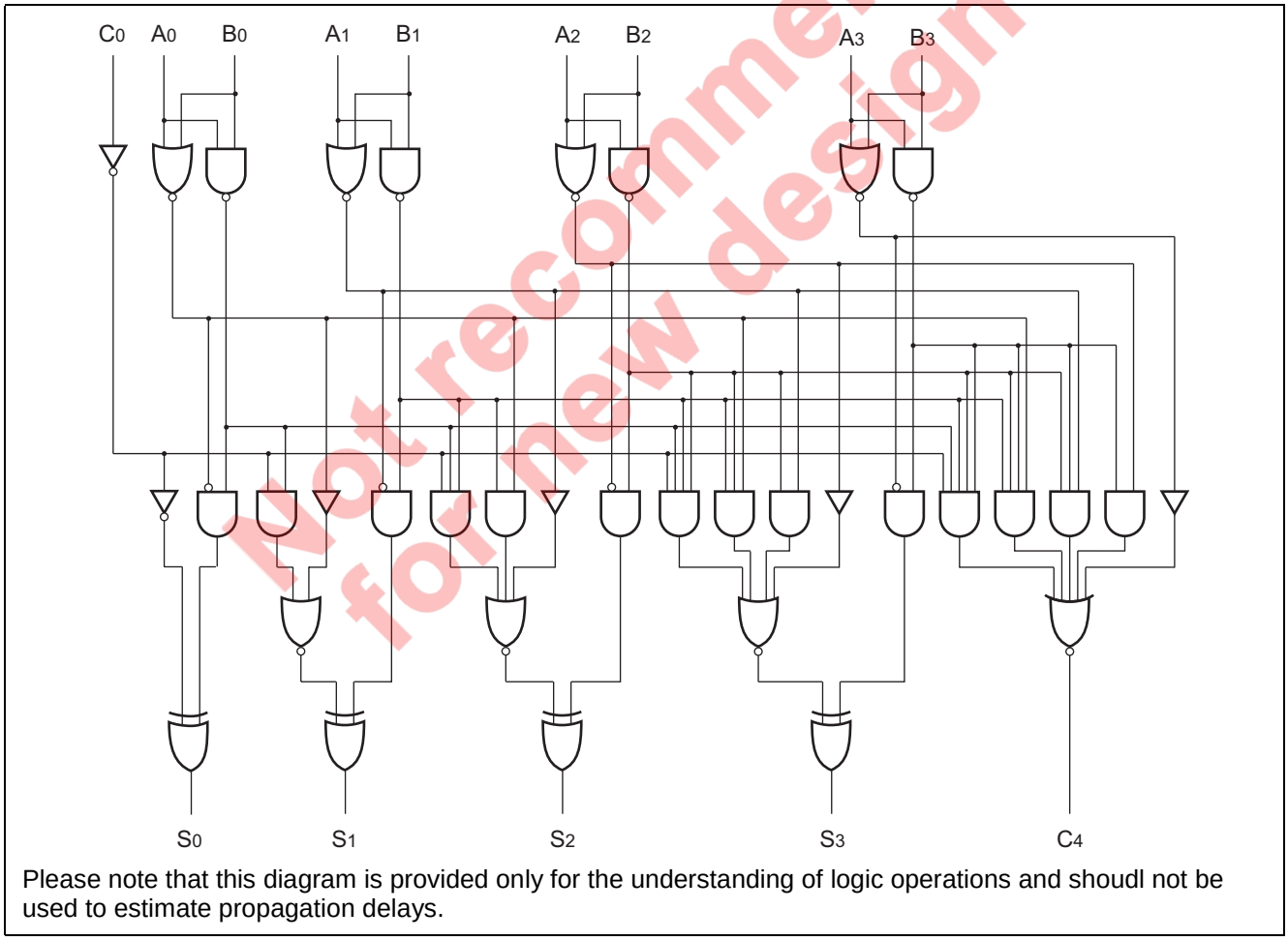


Fig. e 5-Input Majority Gate

Logic Diagram



Please note that this diagram is provided only for the understanding of logic operations and shoudl not be used to estimate propagation delays.

Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Condition
Supply voltage	V_{CC}	–0.5 to 7	V	
DC input diode current	I_{IK}	–20	mA	V_I = –0.5V
		20	mA	V_I = Vcc+0.5V
DC input voltage	V_I	–0.5 to Vcc+0.5	V	
DC output diode current	I_{OK}	–50	mA	V_O = –0.5V
		50	mA	V_O = Vcc+0.5V
DC output voltage	V_O	–0.5 to Vcc+0.5	V	
DC output source or sink current	I_O	±50	mA	
DC V_{CC} or ground current per output pin	I_{CC}, I_{GND}	±50	mA	
Storage temperature	Tstg	–65 to +150	°C	

Recommended Operating Conditions: HD74AC283

Item	Symbol	Ratings	Unit	Condition
Supply voltage	V_{CC}	2 to 6	V	
Input and output voltage	V_I, V_O	0 to V_{CC}	V	
Operating temperature	Ta	–40 to +85	°C	
Input rise and fall time (except Schmitt inputs) V_{IN} 30% to 70% V_{CC}	tr, tf	8	ns/V	V_{CC} = 3.0V
				V_{CC} = 4.5 V
				V_{CC} = 5.5 V

DC Characteristics: HD74AC283

Item	Sym-bol	Vcc (V)	Ta = 25°C			Ta = –40 to +85°C		Unit	Condition	
			min.	typ.	max.	min.	max.			
Input Voltage	V_{IH}	3.0	2.1	1.5	—	2.1	—	V	V_{OUT} = 0.1 V or V_{CC} –0.1 V	
		4.5	3.15	2.25	—	3.15	—			
		5.5	3.85	2.75	—	3.85	—			
	V_{IL}	3.0	—	1.50	0.9	—	0.9		V_{OUT} = 0.1 V or V_{CC} –0.1 V	
		4.5	—	2.25	1.35	—	1.35			
		5.5	—	2.75	1.65	—	1.65			
Output voltage	V_{OH}	3.0	2.9	2.99	—	2.9	—	V	V_{IN} = V_{IL} or V_{IH} I_{OUT} = –50 µA	
		4.5	4.4	4.49	—	4.4	—			
		5.5	5.4	5.49	—	5.4	—			
		3.0	2.58	—	—	2.48	—		V_{IN} = V_{IL} or V_{IH}	I_{OH} = –12 mA
		4.5	3.94	—	—	3.80	—			I_{OH} = –24 mA
		5.5	4.94	—	—	4.80	—			I_{OH} = –24 mA
	V_{OL}	3.0	—	0.002	0.1	—	0.1		V_{IN} = V_{IL} or V_{IH} I_{OUT} = 50 µA	
		4.5	—	0.001	0.1	—	0.1			
		5.5	—	0.001	0.1	—	0.1			
		3.0	—	—	0.32	—	0.37		V_{IN} = V_{IL} or V_{IH}	I_{OL} = 12 mA
		4.5	—	—	0.32	—	0.37			I_{OL} = 24 mA
		5.5	—	—	0.32	—	0.37			I_{OL} = 24 mA
Input leakage current	I_{IN}	5.5	—	—	±0.1	—	±1.0	µA	V_{IN} = V_{CC} or GND	
Dynamic output current*	I_{OLD}	5.5	—	—	—	86	—	mA	V_{OLD} = 1.1 V	
	I_{OHD}	5.5	—	—	—	–75	—	mA	V_{OHD} = 3.85 V	
Quiescent supply current	I_{CC}	5.5	—	—	8.0	—	80	µA	V_{IN} = V_{CC} or ground	

*Maximum test duration 2.0 ms, one output loaded at a time.

Recommended Operating Conditions: HD74ACT283

Item	Symbol	Ratings	Unit	Condition
Supply voltage	V_{CC}	2 to 6	V	
Input and output voltage	V_I, V_O	0 to V_{CC}	V	
Operating temperature	Ta	–40 to +85	°C	
Input rise and fall time (except Schmitt inputs) V_{IN} 0.8 to 2.0 V	tr, tf	8	ns/V	V_{CC} = 4.5V V_{CC} = 5.5V

DC Characteristics: HD74ACT283

Item	Sym-bol	V_{CC} (V)	Ta = 25°C			Ta = –40 to +85°C		Unit	Condition	
			min.	typ.	max.	min.	max.			
Input voltage	V_{IH}	4.5	2.0	1.5	—	2.0	—	V	V_{OUT} = 0.1 V or Vcc–0.1 V	
		5.5	2.0	1.5	—	2.0	—			
	V_{IL}	4.5	—	1.5	0.8	—	0.8		V_{OUT} = 0.1 V or Vcc–0.1 V	
		5.5	—	1.5	0.8	—	0.8			
Output voltage	V_{OH}	4.5	4.4	4.49	—	4.4	—	V	V_{IN} = V_{IL} or V_{IH} I_{OUT} = –50 µA	
		5.5	5.4	5.49	—	5.4	—			
		4.5	3.94	—	—	3.80	—		V_{IN} = V_{IL}	I_{OH} = –24 mA
		5.5	4.94	—	—	4.80	—			I_{OH} = –24 mA
	V_{OL}	4.5	—	0.001	0.1	—	0.1		V_{IN} = V_{IL} or V_{IH} I_{OUT} = 50 µA	
		5.5	—	0.001	0.1	—	0.1			
		4.5	—	—	0.32	—	0.37		V_{IN} = V_{IL}	I_{OL} = 24 mA
		5.5	—	—	0.32	—	0.37			I_{OL} = 24 mA
Input current	I_{IN}	5.5	—	—	±0.1	—	±1.0	µA	V_{IN} = V_{CC} or GND	
I_{CC}/input current	I_{CCT}	5.5	—	0.6	—	—	1.5	mA	V_{IN} = V_{CC}–2.1 V	
Dynamic output current*	I_{OLD}	5.5	—	—	—	86	—	mA	V_{OLD} = 1.1 V	
	I_{OHD}	5.5	—	—	—	–75	—	mA	V_{OHD} = 3.85 V	
Quiescent supply current	I_{CC}	5.5	—	—	8.0	—	80	µA	V_{IN} = V_{CC} or ground	

*Maximum test duration 2.0 ms, one output loaded at a time.

AC Characteristics: HD74AC283

Item	Symbol	V_{CC} (V)*[1]	Ta = +25°C C_L = 50 pF			Ta = –40°C to +85°C C_L = 50 pF		Unit
			Min	Typ	Max	Min	Max	
Propagation delay C_0 to S_n	t_{PLH}	3.3	1.0	11.5	15.0	1.0	16.5	ns
		5.0	1.0	9.5	11.5	1.0	12.5	
Propagation delay C_0 to S_n	t_{PHL}	3.3	1.0	10.5	14.0	1.0	15.5	ns
		5.0	1.0	8.5	10.5	1.0	11.5	
Propagation delay A_n or B_n to S_n	t_{PLH}	3.3	1.0	14.0	17.0	1.0	18.5	ns
		5.0	1.0	11.5	13.5	1.0	14.5	
Propagation delay A_n or B_n to S_n	t_{PHL}	3.3	1.0	13.5	16.5	1.0	18.0	ns
		5.0	1.0	11.0	13.0	1.0	14.0	
Propagation delay C_0 to C_4	t_{PLH}	3.3	1.0	9.5	12.5	1.0	15.5	ns
		5.0	1.0	7.5	9.5	1.0	10.5	
Propagation delay C_0 to C_4	t_{PHL}	3.3	1.0	10.0	13.0	1.0	14.0	ns
		5.0	1.0	8.0	10.0	1.0	11.0	
Propagation delay A_n or B_n to C_4	t_{PLH}	3.3	1.0	11.5	14.5	1.0	16.0	ns
		5.0	1.0	9.5	11.5	1.0	12.5	
Propagation delay A_n or B_n to C_4	t_{PHL}	3.3	1.0	12.0	15.0	1.0	16.5	ns
		5.0	1.0	10.0	12.0	1.0	13.0	

Note: 1. Voltage Range 3.3 is 3.3 V ± 0.3 V
Voltage Range 5.0 is 5.0 V ± 0.5 V

AC Characteristics: HD74ACT283

Item	Symbol	V_{CC} (V)*[1]	Ta = +25°C C_L = 50 pF			Ta = –40°C to +85°C C_L = 50 pF		Unit
			Min	Typ	Max	Min	Max	
Propagation delay C_0 to S_n	t_{PLH}	5.0	1.0	11.5	13.5	1.0	14.5	ns
Propagation delay C_0 to S_n	t_{PHL}	5.0	1.0	10.0	12.0	1.0	13.0	ns
Propagation delay A_n or B_n to S_n	t_{PLH}	5.0	1.0	13.0	15.0	1.0	16.5	ns
Propagation delay A_n or B_n to S_n	t_{PHL}	5.0	1.0	12.0	14.0	1.0	15.5	ns
Propagation delay C_0 to C_4	t_{PLH}	5.0	1.0	9.0	11.0	1.0	12.0	ns
Propagation delay C_0 to C_4	t_{PHL}	5.0	1.0	10.0	12.0	1.0	13.0	ns
Propagation delay A_n or B_n to C_4	t_{PLH}	5.0	1.0	11.0	13.0	1.0	14.0	ns
Propagation delay A_n or B_n to C_4	t_{PHL}	5.0	1.0	11.5	13.5	1.0	14.5	ns

Note: 1. Voltage Range 5.0 is 5.0 V ± 0.5 V

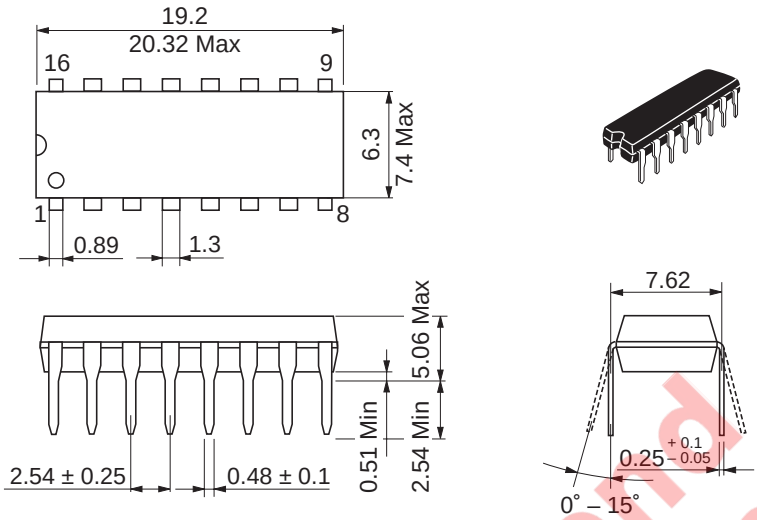
Capacitance

Item	Symbol	Typ	Unit	Condition
Input capacitance	C_{IN}	4.5	pF	V_{CC} = 5.5 V
Power dissipation capacitance	C_{PD}	60.0	pF	V_{CC} = 5.0 V

Package Dimensions

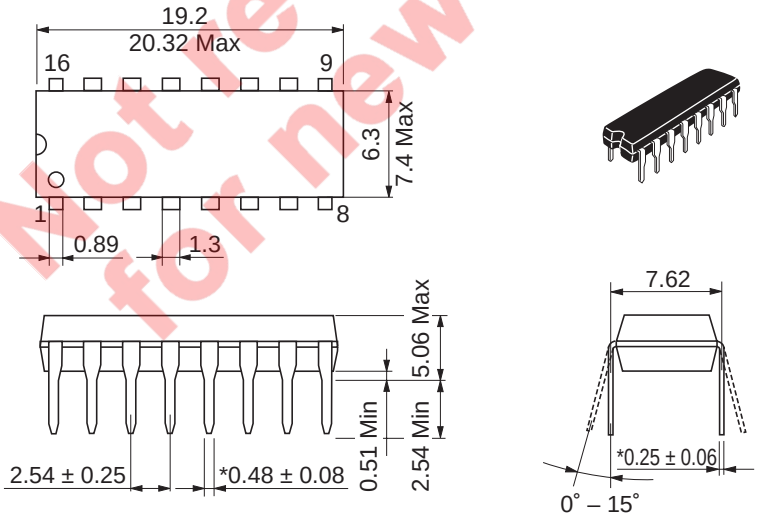
As of January, 2003

Unit: mm



Package Code	DP-16E
JEDEC	Conforms
JEITA	Conforms
Mass (reference value)	1.05 g

Unit: mm

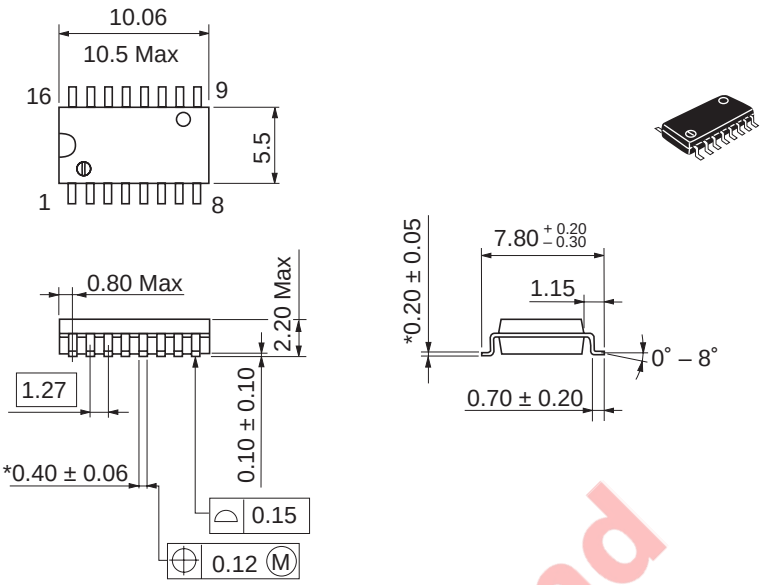


Package Code	DP-16FV
JEDEC	Conforms
JEITA	Conforms
Mass (reference value)	1.05 g

*NI/Pd/AU Plating

As of January, 2003

Unit: mm

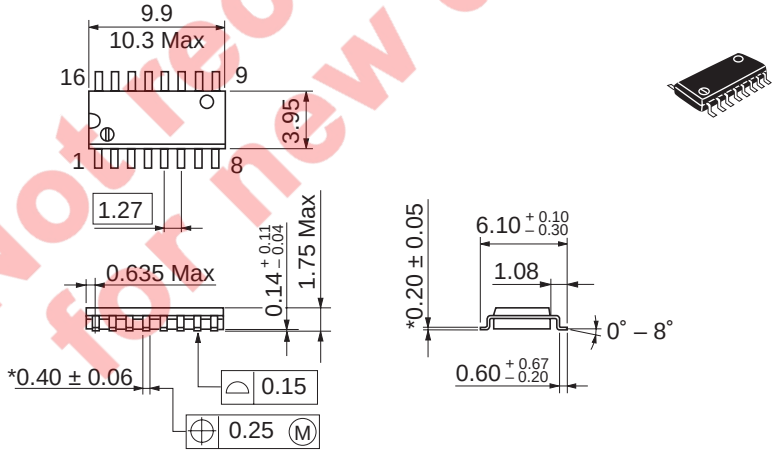


*Ni/Pd/Au plating

Package Code	FP-16DAV
JEDEC	—
JEITA	Conforms
Mass (reference value)	0.24 g

As of January, 2003

Unit: mm



*Ni/Pd/Au plating

Package Code	FP-16DNV
JEDEC	Conforms
JEITA	Conforms
Mass (reference value)	0.15 g

Renesas Technology Corp. Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

RENESAS SALES OFFICES

http://www.renesas.com

Renesas Technology America, Inc.
450 Holger Way, San Jose, CA 95134-1368, U.S.A
Tel: <1> (408) 382-7500 Fax: <1> (408) 382-7501

Renesas Technology Europe Limited.
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, United Kingdom
Tel: <44> (1628) 585 100, Fax: <44> (1628) 585 900

Renesas Technology Europe GmbH
Dornacher Str. 3, D-85622 Feldkirchen, Germany
Tel: <49> (89) 380 70 0, Fax: <49> (89) 929 30 11

Renesas Technology Hong Kong Ltd.
7/F., North Tower, World Finance Centre, Harbour City, Canton Road, Hong Kong
Tel: <852> 2265-6688, Fax: <852> 2375-6836

Renesas Technology Taiwan Co., Ltd.
FL 10, #99, Fu-Hsing N. Rd., Taipei, Taiwan
Tel: <886> (2) 2715-2888, Fax: <886> (2) 2713-2999

Renesas Technology (Shanghai) Co., Ltd.
26/F., Ruijin Building, No.205 Maoming Road (S), Shanghai 200020, China
Tel: <86> (21) 6472-1001, Fax: <86> (21) 6415-2952

Renesas Technology Singapore Pte. Ltd.
1, Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: <65> 6213-0200, Fax: <65> 6278-8001

Colophon .1.0