

HD74LS83A

4-bit Binary Full Adder (with Fast Carry)

REJ03D0420-0200

Rev.2.00

Feb.18.2005

This improved full adder performs the addition of two 4-bit binary numbers. The sum (Σ) outputs are provided for each bit and the resultant carry (C_4) is obtained from the fourth bit. This adder features full internal look ahead across all four bit generating the carry term in ten nanoseconds typically. This provides the system designer with partial look-ahead performance at the economy and reduced package count of a ripple-carry implementation.

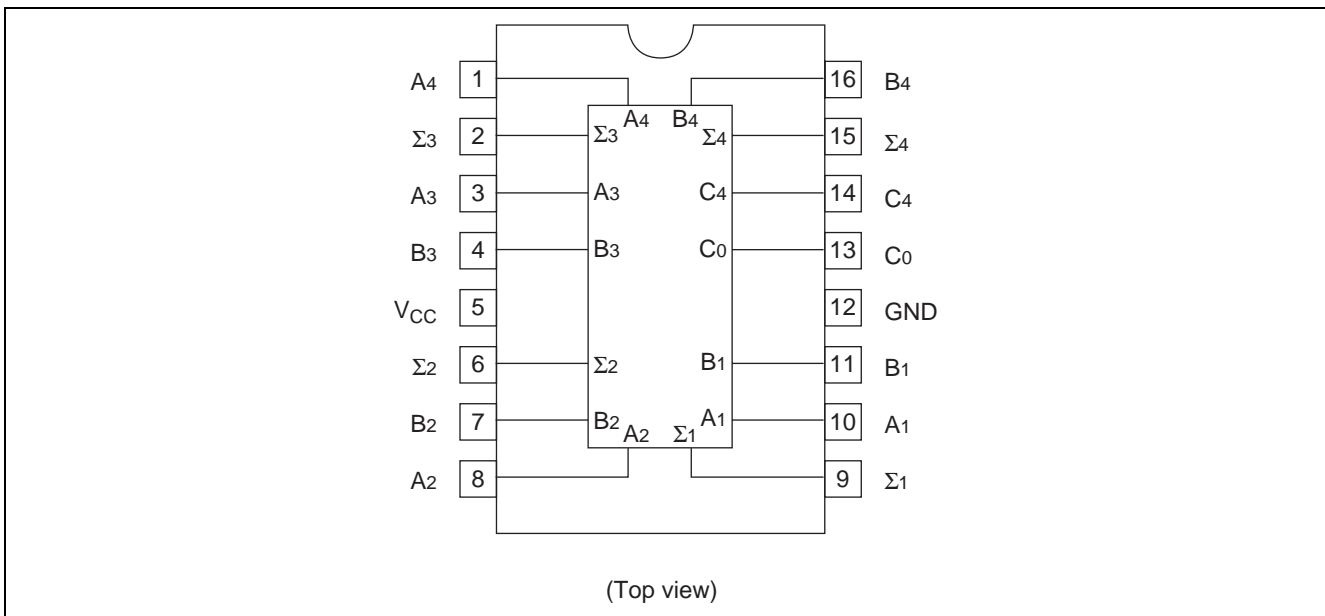
Features

- Ordering Information

Part Name	Package Type	Package Code (Previous Code)	Package Abbreviation	Taping Abbreviation (Quantity)
HD74LS83AP	DILP-16 pin	PRDP0016AE-B (DP-16FV)	P	—

Note: Please consult the sales office for the above package availability.

Pin Arrangement



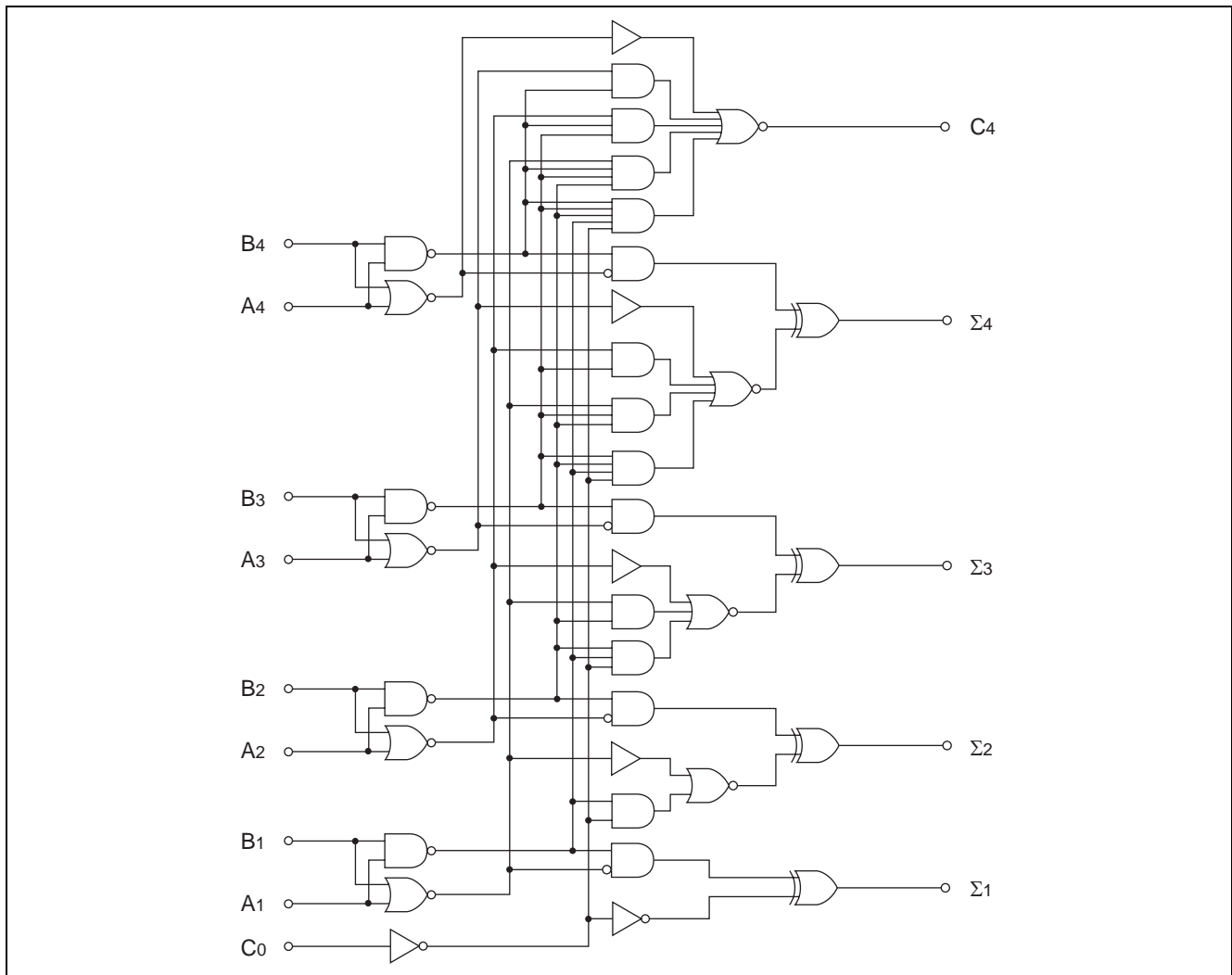
Function Table

Input				Output					
				When C ₀ = L			When C ₀ = H		
A ₁	B ₁	A ₂	B ₂	Σ ₁	Σ ₂	C ₂	Σ ₁	Σ ₂	C ₂
A ₃	B ₃	A ₄	B ₄	Σ ₃	Σ ₄	C ₄	Σ ₃	Σ ₄	C ₄
L	L	L	L	L	L	L	H	L	L
H	L	L	L	H	L	L	L	H	L
L	H	L	L	H	L	L	L	H	L
H	H	L	L	L	H	L	H	H	L
L	L	H	L	L	H	L	H	H	L
H	L	H	L	H	H	L	L	L	H
L	H	H	L	H	H	L	L	L	H
H	H	H	L	L	L	H	H	L	H
L	L	L	H	L	H	L	H	H	L
H	L	L	H	H	H	L	L	L	H
L	H	L	H	H	H	L	L	L	H
H	H	L	H	L	L	H	H	L	H
L	L	H	H	L	L	H	H	L	H
H	L	H	H	H	L	H	L	H	H
L	H	H	H	H	L	H	L	H	H
H	H	H	H	L	H	H	H	H	H

H; high level, L; low level, X; irrelevant

Note: Input conditions at A₁, B₁, A₂, B₂, and C₀ are used to determine outputs Σ₁ and Σ₂ and the value of the internal carry C₂. The value at C₂, A₃, B₃, A₄, and B₄ are then used to determine outputs Σ₃, Σ₄ and C₄.

Block Diagram



Absolute Maximum Ratings

Item	Symbol	Ratings	Unit
Supply voltage	V_{CC}	7	V
Input voltage	V_{IN}	7	V
Power dissipation	P_T	400	mW
Storage temperature	T_{stg}	-65 to +150	°C

Note: Voltage value, unless otherwise noted, are with respect to network ground terminal.

Recommended Operating Conditions

Item	Symbol	Min	Typ	Max	Unit
Supply voltage	V_{CC}	4.75	5.00	5.25	V
Output current	I_{OH}	—	—	-400	μA
	I_{OL}	—	—	8	mA
Operating temperature	T_{opr}	-20	25	75	°C

Electrical Characteristics

(Ta = -20 to +75 °C)

Item	Symbol	min.	typ.*	max.	Unit	Condition
Input voltage	V _{IH}	2.0	—	—	V	
	V _{IL}	—	—	0.8	V	
Output voltage	V _{OH}	2.7	—	—	V	V _{CC} = 4.75 V, V _{IH} = 2 V, V _{IL} = 0.8 V, I _{OH} = -400 μA
	V _{OL}	—	—	0.4	V	V _{CC} = 4.75 V, V _{IH} = 2 V, V _{IL} = 0.8 V
—		—	0.5			
Input current	except C ₀	—	—	40	μA	V _{CC} = 5.25 V, V _I = 2.7 V
	C ₀			20		
	except C ₀	—	—	-0.8	mA	
	C ₀			-0.4		
	except C ₀	—	—	0.2	mA	
	C ₀			0.1		
Short-circuit output current	I _{OS}	-20	—	-100	mA	V _{CC} = 5.25 V
Supply current	I _{CC}	—	22	39	mA	All inputs = 0 V
		—	19	34		B input = 0.8 V, Other inputs 4.5 V
		—	19	34		All inputs = 4.5 V
Input clamp voltage	V _{IR}	—	—	-1.5	V	V _{CC} = 4.75 V, I _{IN} = -18 mA

Note: * V_{CC} = 5 V, Ta = 25°C

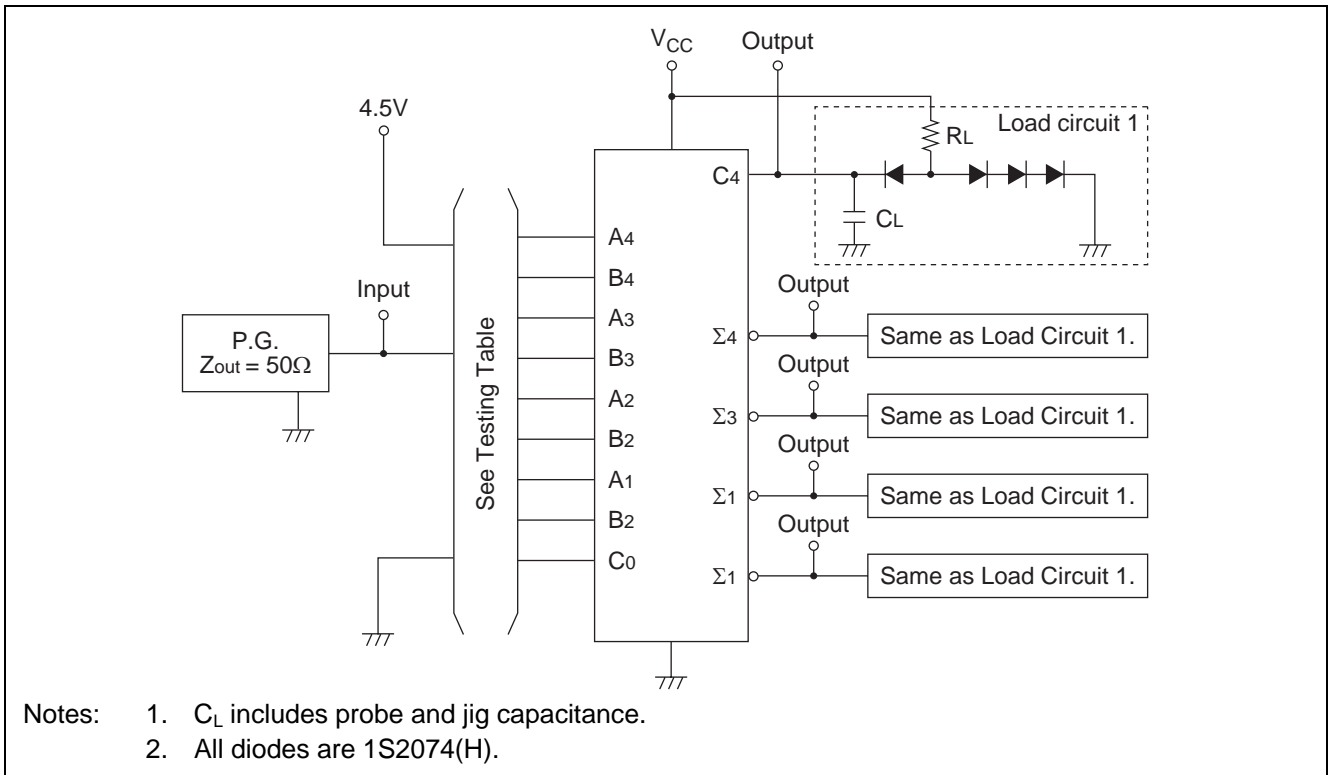
Switching Characteristics

(V_{CC} = 5 V, Ta = 25°C)

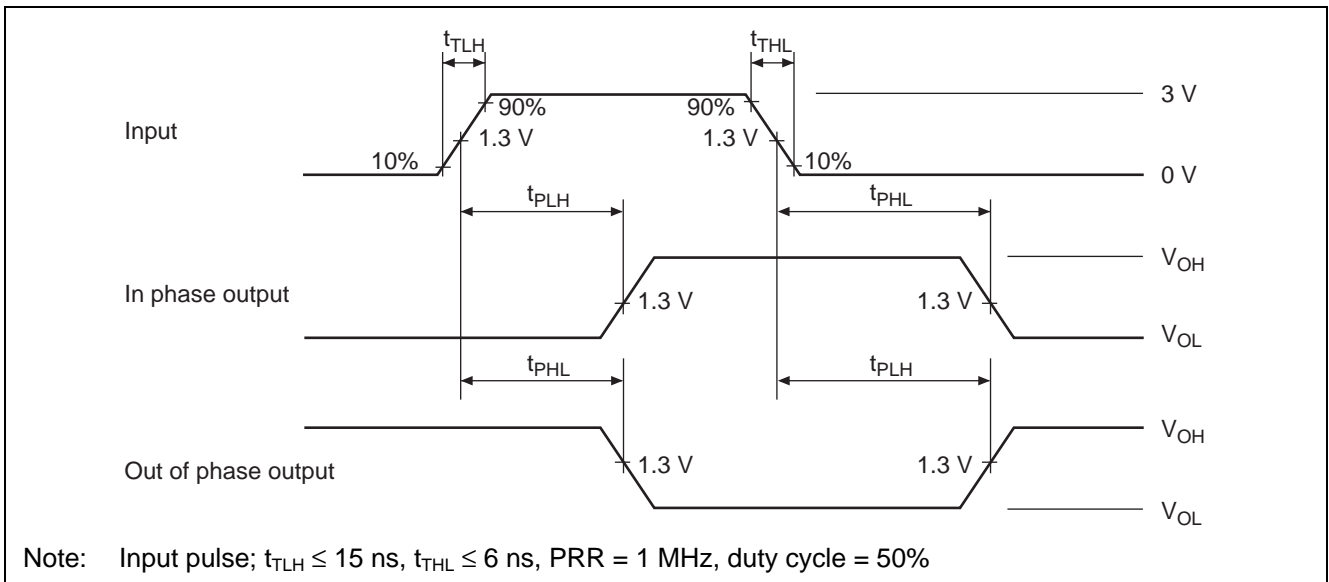
Item	Symbol	Inputs	Outputs	min.	typ.	max.	Unit	Condition
Propagation delay time	t _{PLH}	C ₀	Σ ₁	—	16	24	ns	C _L = 15 pF, R _L = 2 kΩ
	t _{PHL}			—	15	24		
	t _{PLH}	A _i , B _i	Σ ₁	—	15	24		
	t _{PHL}			—	15	24		
	t _{PLH}	C ₀	C ₄	—	11	17		
	t _{PHL}			—	15	22		
	t _{PLH}	A _i , B _i	C ₄	—	11	17		
	t _{PHL}			—	12	17		

Testing Method

Test Circuit



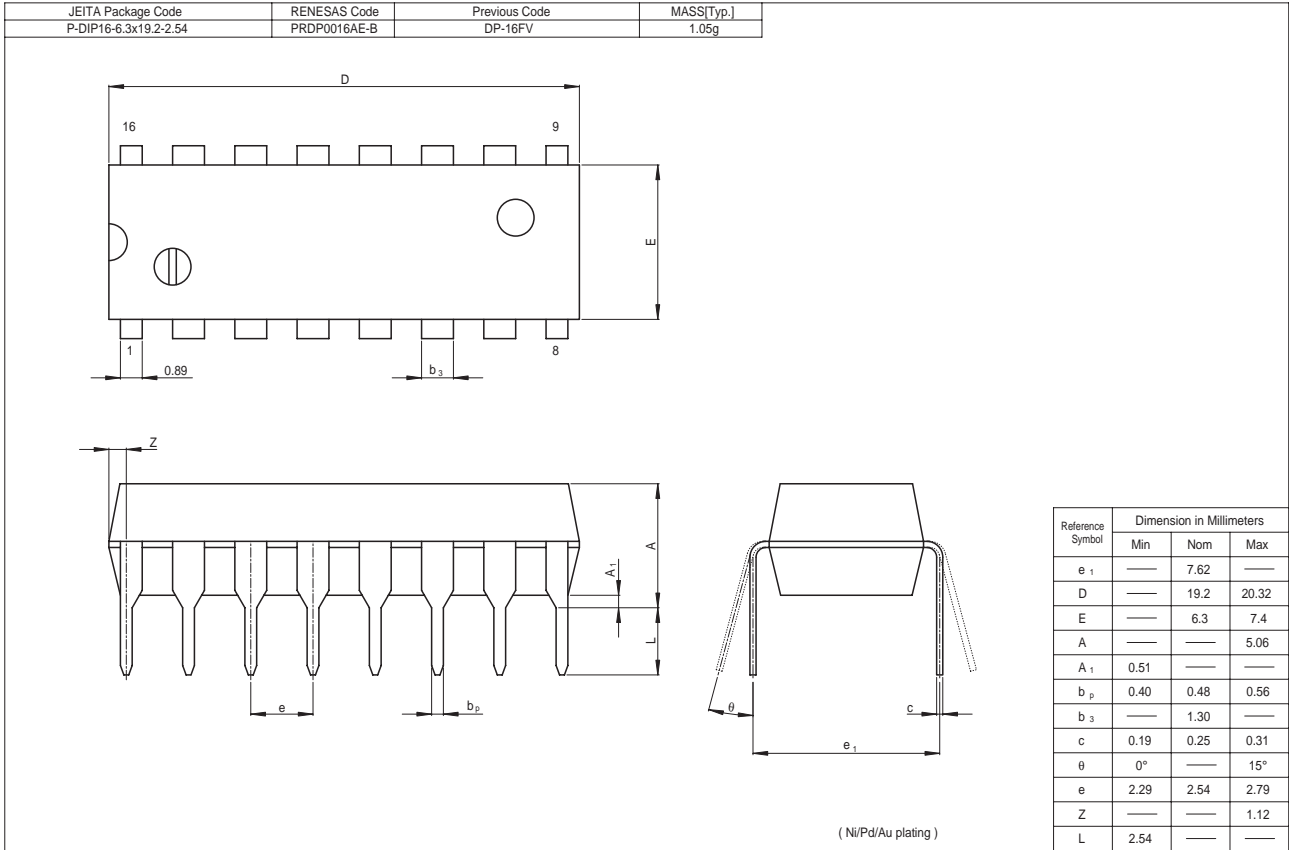
Waveform



Testing Table

Item	From input to output	Input									Output							
		B ₄	A ₄	B ₃	A ₃	B ₂	A ₂	B ₁	A ₁	C ₀	C ₄	Σ ₄	Σ ₃	Σ ₂	Σ ₁			
t _{PLH} t _{PHL}	C ₀ → Σ _i or C ₄	GND	GND	GND	GND	GND	GND	GND	GND	GND	IN	—	—	—	—	OUT		
		GND	GND	GND	4.5 v	GND	4.5 v	GND	4.5 v	IN	IN	OUT	OUT	OUT	OUT	OUT		
	A _i or B _i → Σ _i or C ₄	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	—	—	—	—	OUT	
																		GND
		GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	—	—	—	OUT	—
		GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	—	—	OUT	—	—
		GND	IN	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	—	OUT	—	—	—
		GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	—	—	—	OUT	OUT
		GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	—	—	OUT	OUT	—
GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	—	OUT	OUT	—	—		
																	4.5 v	IN

Package Dimensions



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

Keep safety first in your circuit designs!

1. Renesas Technology Corp. puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage.
Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.

Notes regarding these materials

1. These materials are intended as a reference to assist our customers in the selection of the Renesas Technology Corp. product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Renesas Technology Corp. or a third party.
2. Renesas Technology Corp. assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
3. All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Renesas Technology Corp. without notice due to product improvements or other reasons. It is therefore recommended that customers contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor for the latest product information before purchasing a product listed herein.
The information described here may contain technical inaccuracies or typographical errors.
Renesas Technology Corp. assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.
Please also pay attention to information published by Renesas Technology Corp. by various means, including the Renesas Technology Corp. Semiconductor home page (<http://www.renesas.com>).
4. When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Renesas Technology Corp. assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
5. Renesas Technology Corp. semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
6. The prior written approval of Renesas Technology Corp. is necessary to reprint or reproduce in whole or in part these materials.
7. If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.
Any diversion or reexport contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
8. Please contact Renesas Technology Corp. for further details on these materials or the products contained therein.



RENESAS SALES OFFICES

<http://www.renesas.com>

Refer to "<http://www.renesas.com/en/network>" for the latest and detailed information.

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, U.K.
Tel: <44> (1628) 585-100, Fax: <44> (1628) 585-900

Renesas Technology Hong Kong Ltd.
7th Floor, North Tower, World Finance Centre, Harbour City, 1 Canton Road, Tsimshatsui, Kowloon, Hong Kong
Tel: <852> 2265-6688, Fax: <852> 2730-6071

Renesas Technology Taiwan Co., Ltd.
10th Floor, No.99, Fushing North Road, Taipei, Taiwan
Tel: <886> (2) 2715-2888, Fax: <886> (2) 2713-2999

Renesas Technology (Shanghai) Co., Ltd.
Unit2607 Ruijing 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