

HD74LS192

Synchronous Up / Down Decade Counter (dual clock lines)

REJ03D0454-0200

Rev.2.00

Feb.18.2005

Synchronous operation is provided by having all flip-flops clocked simultaneously so that the output change coincidentally with each other when so instructed by the steering logic. This mode of operation eliminates the output counting spikes which are normally associated with asynchronous (ripple clock) counters. The outputs of the four master-slave flip-flops are triggered by a low-to-high-level transition of either count (clock) input. The direction of counting is determined by which count input is pulsed while the other count input is high. This counter is fully programmable; that is, each output may be preset to either level by desired data at the data inputs while the load inputs is low. The output will change to agree with the data inputs independently of the count pulses. This feature allows the counters to be used as modulo-N dividers by simply modifying the count length with the preset inputs. A clear input has been provided which forces all outputs to the low level when a high level is applied. The clear function is independent of the count and load inputs. The clear, count, and load inputs are buffered to lower the drive requirements. This reduces the number of clock drivers, etc., required for long words. This counter was designed to be cascaded without the need for external circuitry. Both borrow and carry outputs are available to cascade both the up-and down-counting functions.

The borrow output produces a pulse equal in width to the count-down input when the counter underflows. Similarly, the carry output produces a pulse equal in width to the count up input when an overflow condition exists.

The counters can be easily cascaded by feeding the borrow and carry outputs to the count-down and count-up inputs respectively of the succeeding counter.

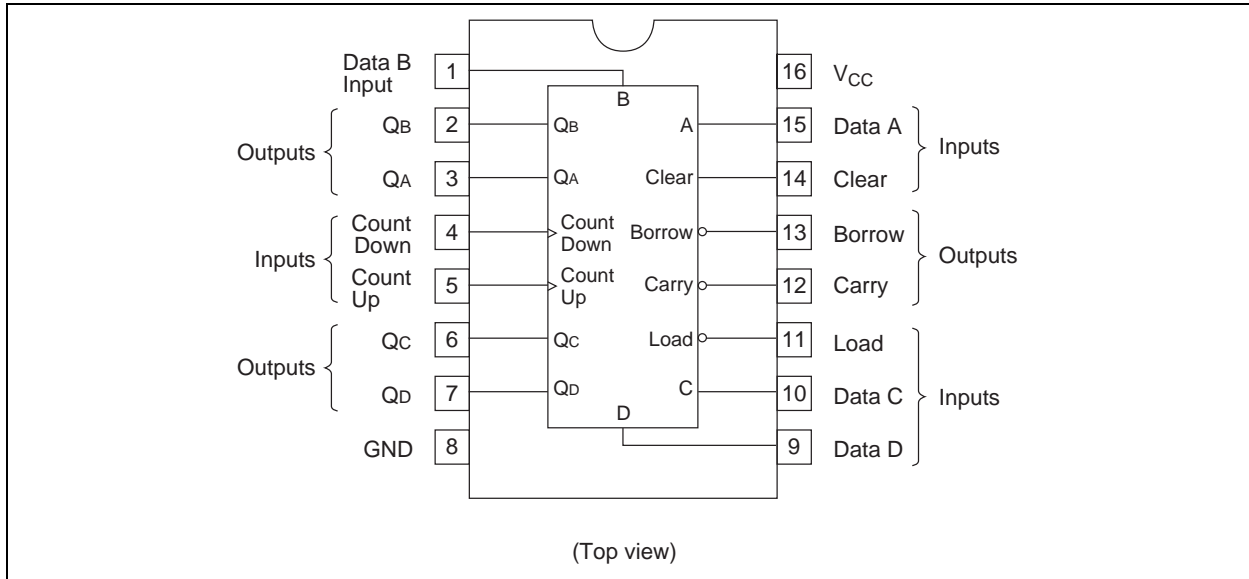
Features

- Ordering Information

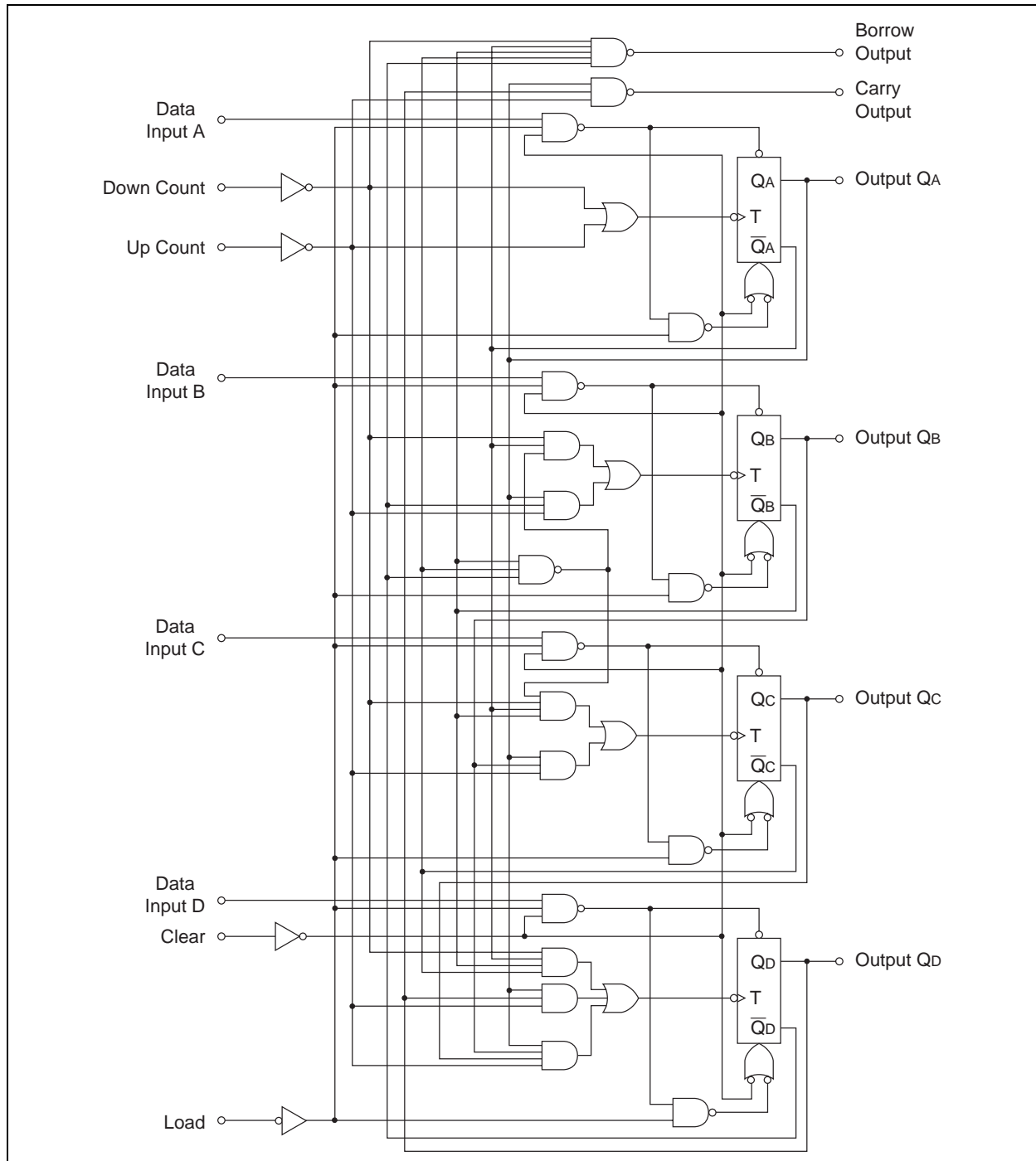
Part Name	Package Type	Package Code (Previous Code)	Package Abbreviation	Taping Abbreviation (Quantity)
HD74LS192P	DILP-16 pin	PRDP0016AE-B (DP-16FV)	P	—
HD74LS192FPEL	SOP-16 pin (JEITA)	PRSP0016DH-B (FP-16DAV)	FP	EL (2,000 pcs/reel)

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

Pin Arrangement



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	μ A
	I_{OL}	—	—	8	mA
Operating temperature	T_{opr}	-20	25	75	$^{\circ}$ C
Clock frequency	f_{clock}	0	—	25	MHz
Pulse width	t_w	20	—	—	ns
Setup time (Clear)	$t_{su (CLR)}$	40	—	—	ns
Setup time	t_{su}	20	—	—	ns
Hold time	t_h	3	—	—	ns

Electrical Characteristics

(Ta = -20 to +75 $^{\circ}$ 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, $I_{OH} = -400$ μ A
	V_{OL}	—	—	0.4	V	$V_{CC} = 4.75$ V, $V_{IH} = 2$ V, $V_{IL} = 0.8$ V
—		—	0.5			
Input current	I_{IH}	—	—	20	μ A	$V_{CC} = 5.25$ V, $V_I = 2.7$ V
	I_{IL}	—	—	-0.4	mA	$V_{CC} = 5.25$ V, $V_I = 0.4$ V
	I_I	—	—	0.1	mA	$V_{CC} = 5.25$ V, $V_I = 7$ V
Short-circuit output current	I_{OS}	-20	—	-100	mA	$V_{CC} = 5.25$ V
Supply current**	I_{CC}	—	19	34	mA	$V_{CC} = 5.25$ V
Input clamp voltage	V_{IK}	—	—	-1.5	V	$V_{CC} = 4.75$ V, $I_{IN} = -18$ mA

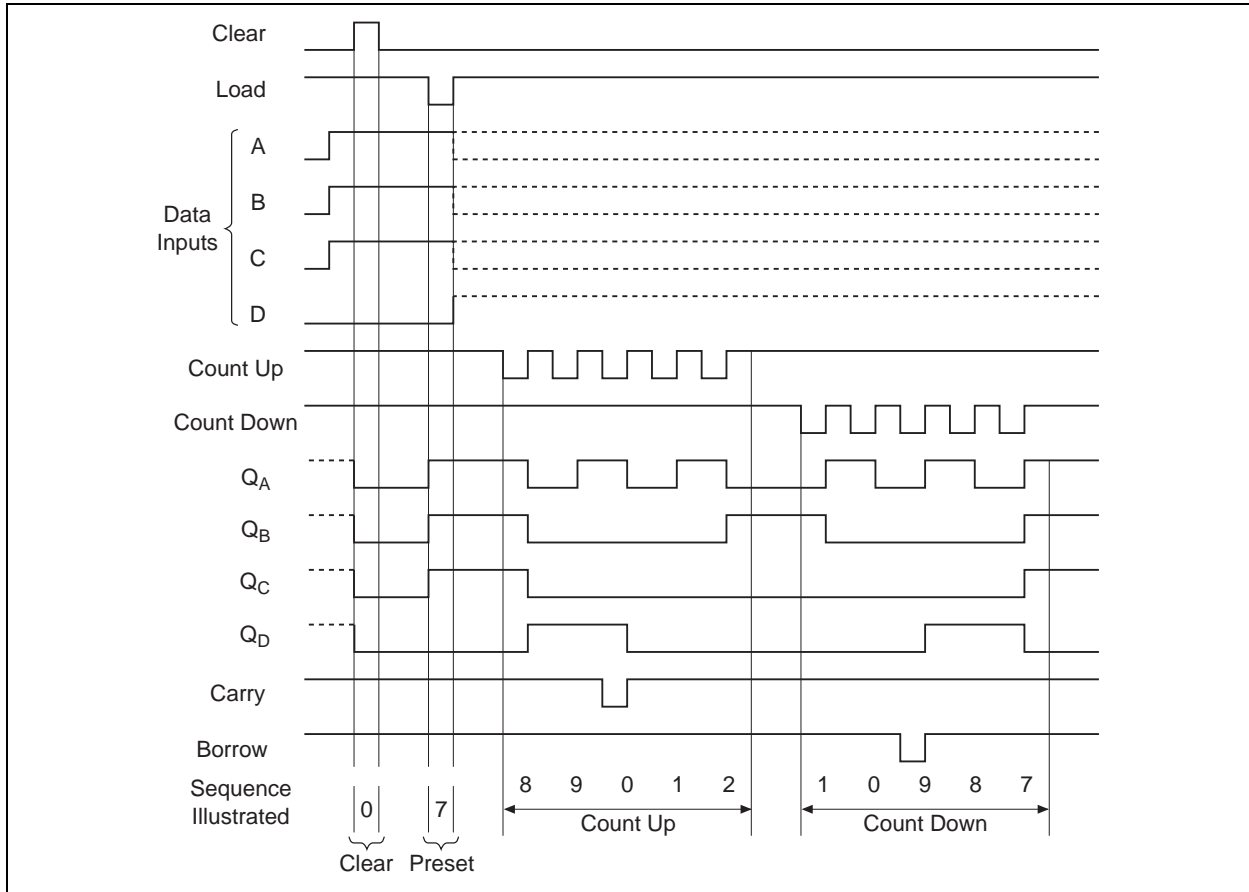
Notes: * $V_{CC} = 5$ V, Ta = 25 $^{\circ}$ C** I_{CC} is measured with all outputs open, clear and load inputs grounded, and all other inputs at 4.5 V.

Switching Characteristics

(V_{CC} = 5 V, Ta = 25 $^{\circ}$ C)

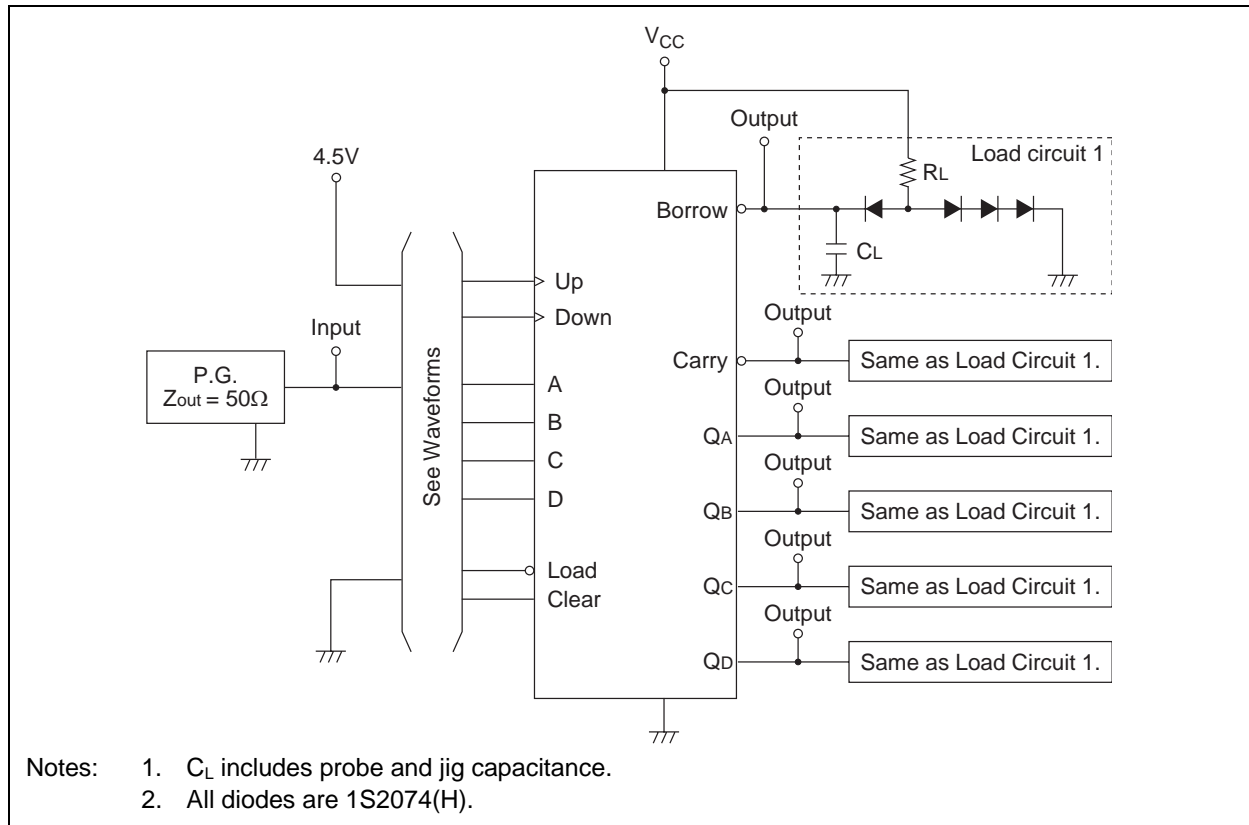
Item	Symbol	Inputs	Outputs	min.	typ.	max.	Unit	Condition
Maximum clock frequency	f_{max}			25	32	—	MHz	$C_L = 15$ pF, $R_L = 2$ k Ω
Propagation delay time	t_{PLH}	Count-up	Carry	—	17	26	ns	
	t_{PHL}			—	18	24		
	t_{PLH}	Count-down	Borrow	—	16	24	ns	
	t_{PHL}			—	15	24		
	t_{PLH}	Either Count	Q	—	27	38	ns	
	t_{PHL}			—	30	47		
	t_{PLH}	Load	Q	—	24	40	ns	
t_{PHL}	—			25	40			
t_{PHL}	Clear	Q	—	23	35	ns		

Count Sequence



Testing Method

Test Circuit



Testing Table

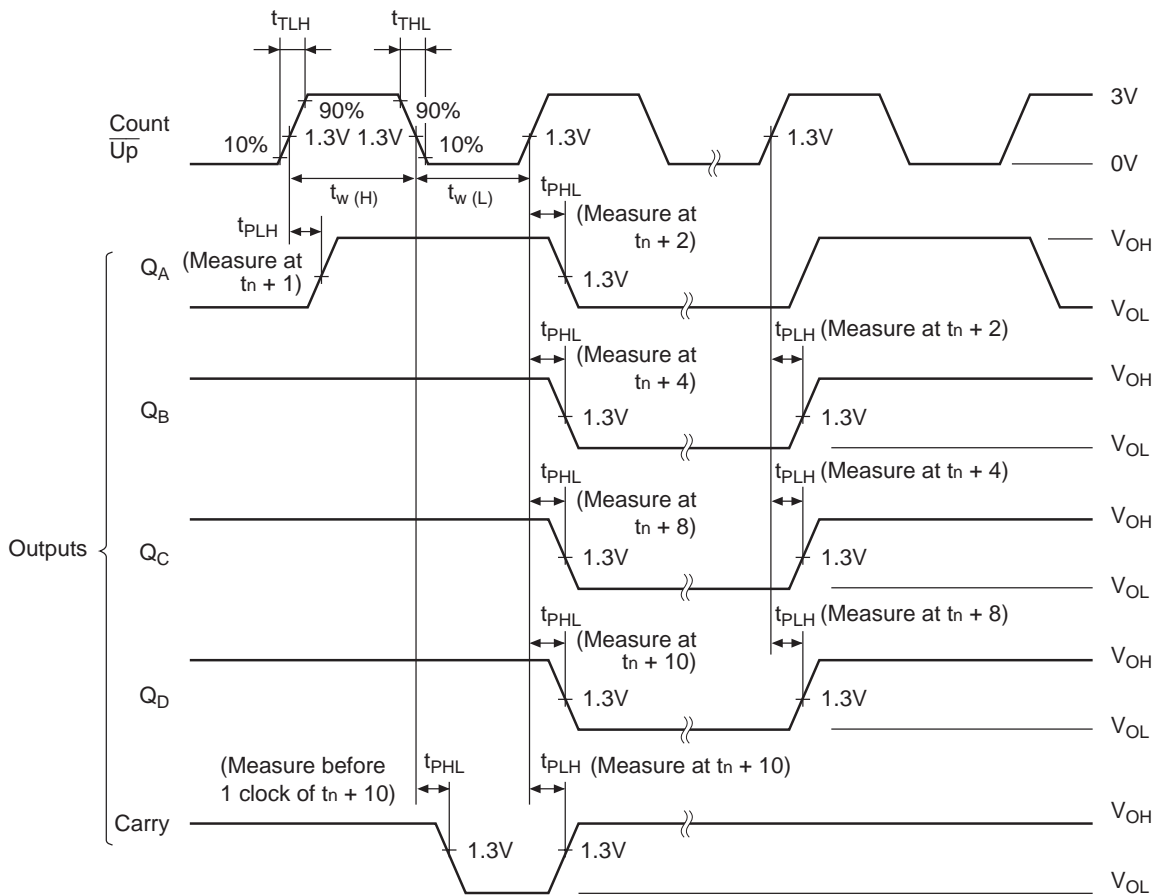
Item	From input to output	Inputs							
		CLR	Load	Up	Down	A	B	C	D
f_{max}		GND	4.5V	IN	4.5V	GND	GND	GND	GND
		GND	4.5V	4.5V	IN	GND	GND	GND	GND
t_{PLH}	Up Count	GND	4.5V	IN	4.5V	GND	GND	GND	GND
	Down Count	GND	4.5V	4.5V	IN	GND	GND	GND	GND
t_{PHL}	Load→Q	GND	IN	GND	GND	IN	IN	IN	IN
	Clear→Q	IN	IN*	GND	GND	4.5V	4.5V	4.5V	4.5V

Note: *. For initialized

Item	From input to output	Outputs					
		Q _A	Q _B	Q _C	Q _D	Carry	Borrow
f_{max}		OUT	OUT	OUT	OUT	OUT	—
		OUT	OUT	OUT	OUT	—	OUT
t_{PLH}	Up Count	OUT	OUT	OUT	OUT	OUT	—
	Down Count	OUT	OUT	OUT	OUT	—	OUT
t_{PHL}	Load→Q	OUT	OUT	OUT	OUT	—	—
	Clear→Q	OUT	OUT	OUT	OUT	—	—

Waveforms 1

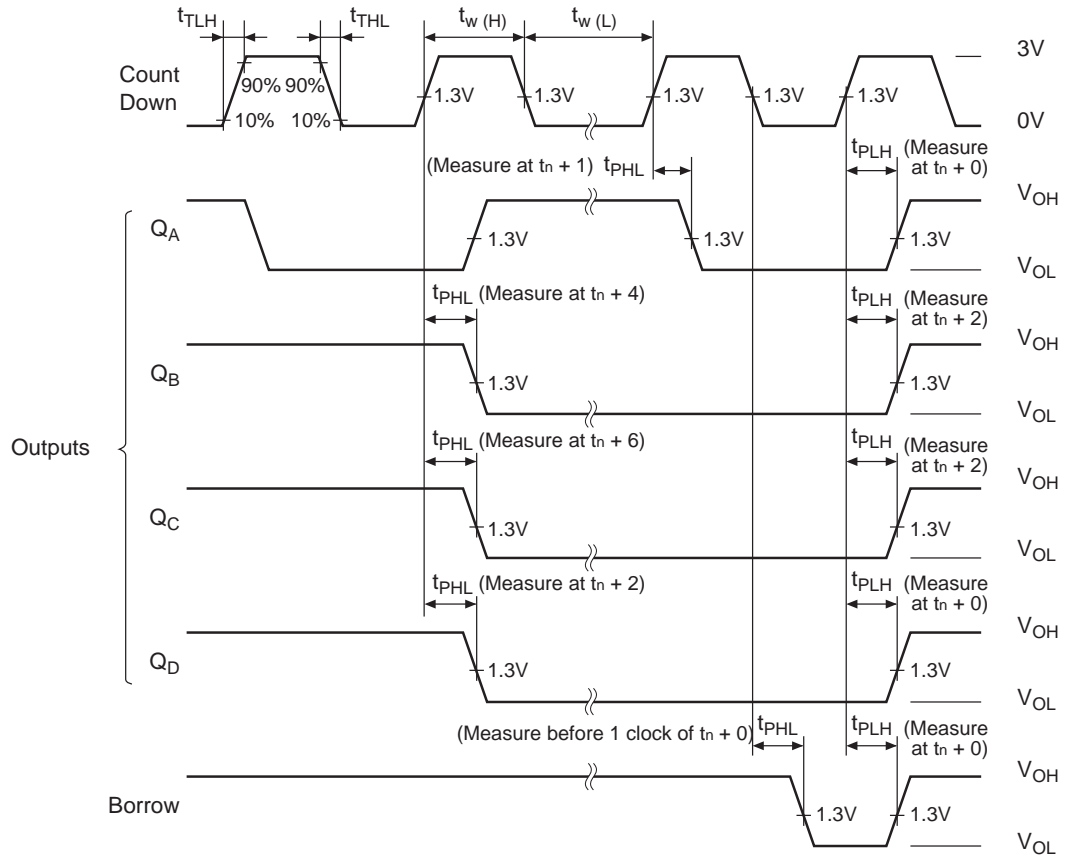
f_{max} , t_{PLH} , t_{PHL} , (Count Up)



- Notes:
1. Input pulse; t_{TLH} , $t_{THL} \leq 7$ ns, PRR = 500 kHz (Data input). PRR = 1 MHz (except data input) Duty cycle = 50%
 2. for f_{max} t_{TLH} , $t_{THL} \leq 2.5$ ns.
 3. t_n is reference bit time when all outputs are low.

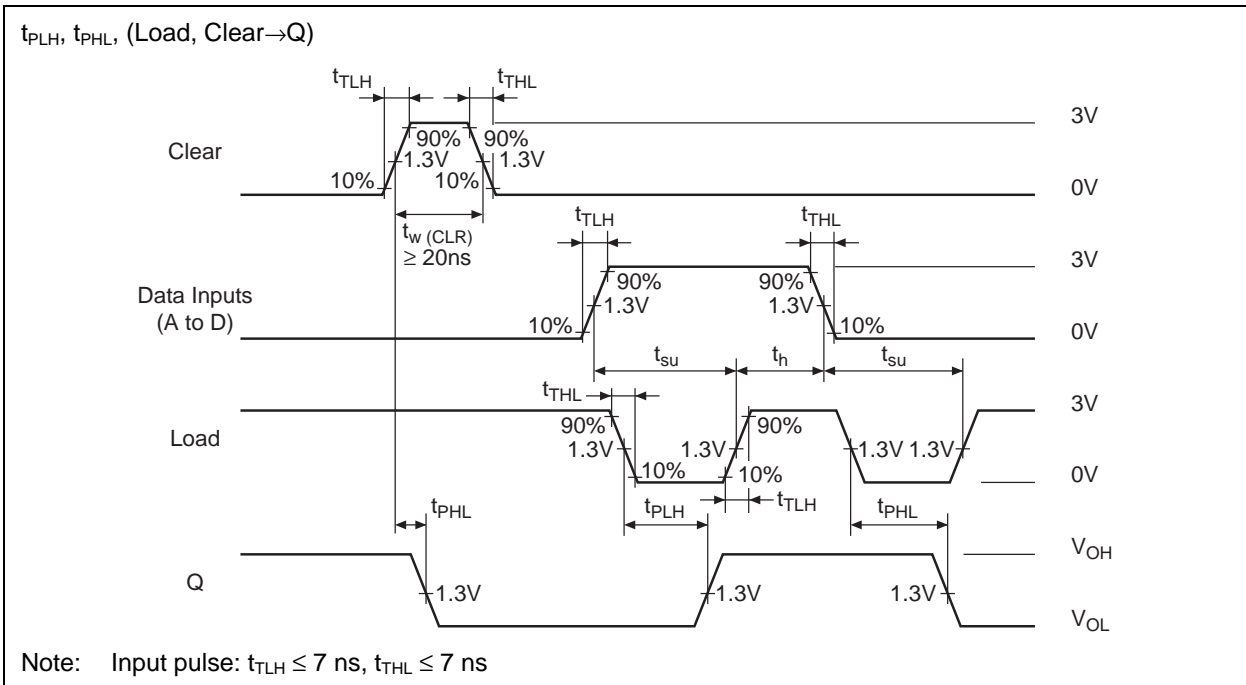
Waveforms 2

f_{max} , t_{PLH} , t_{PHL} , (Count Down)

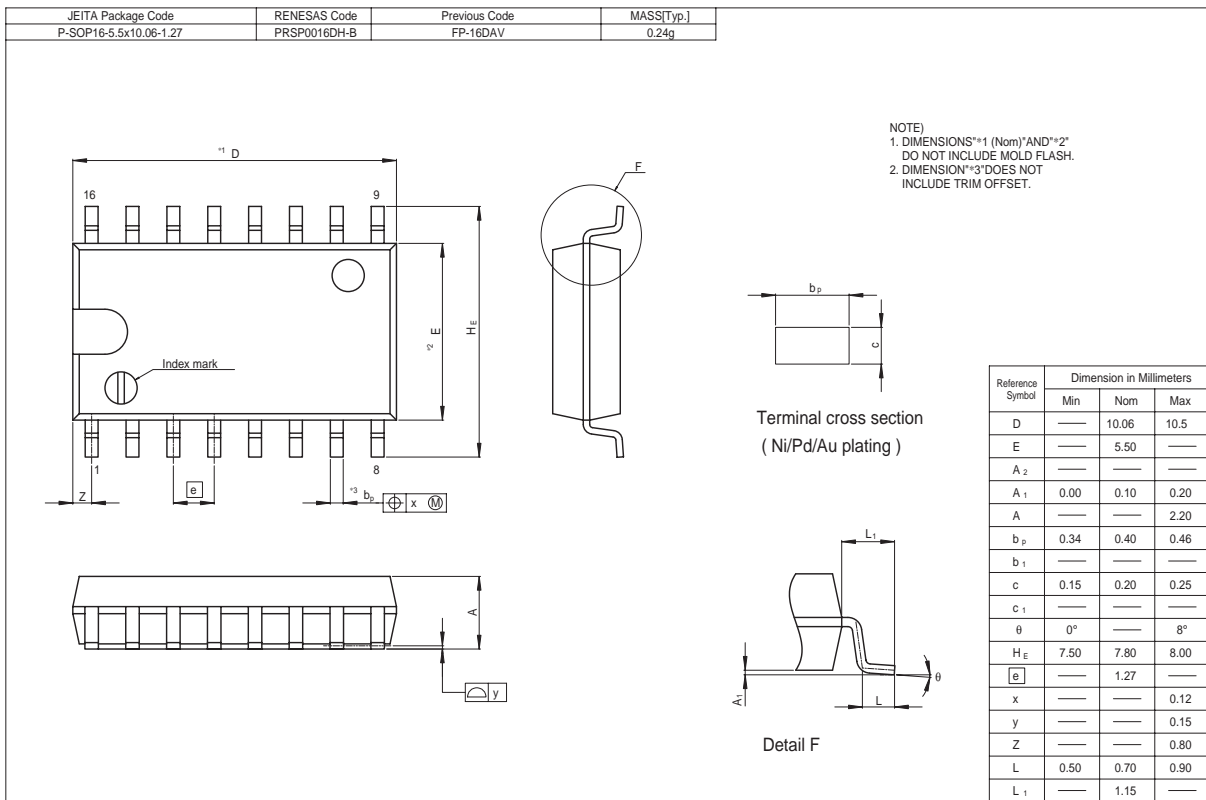
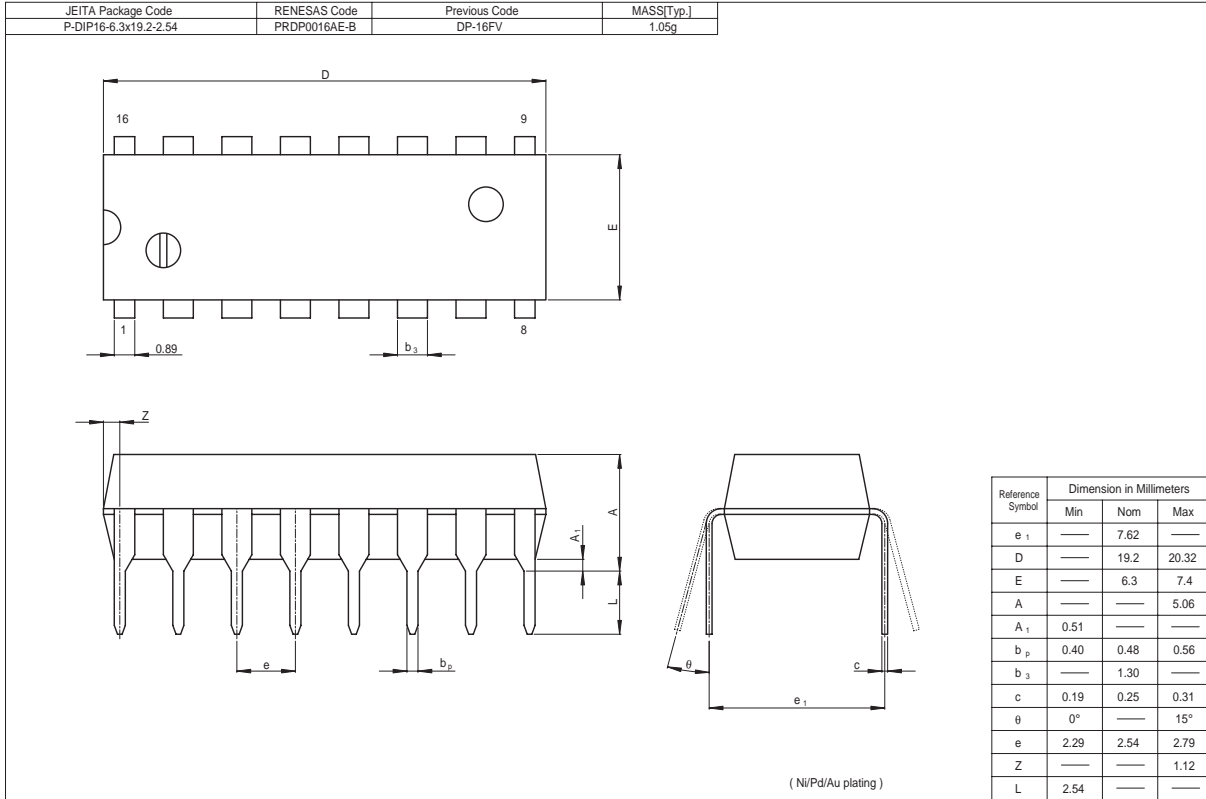


- Notes:
1. for f_{max} t_{TLH} , $t_{THL} \leq 2.5$ ns.
 2. t_n is reference bit time when all outputs are high.

Waveforms 3



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