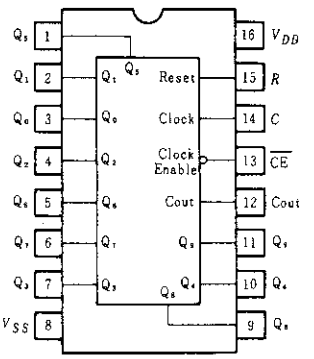
Decade Counter/Divider

The HD14017B is a five-stage Johnson decade counter with built-in code converter. High speed operation and spike free outputs are obtained by use of a Johnson decade counter design. The ten decoded outputs are normally low, and go high only at their appropriate decimal time period. The output changes occur on the positive going edge of the clock pulse. This part can be used in frequency division applications as well as decade counter or decimal decode display applications.

■ FEATURES

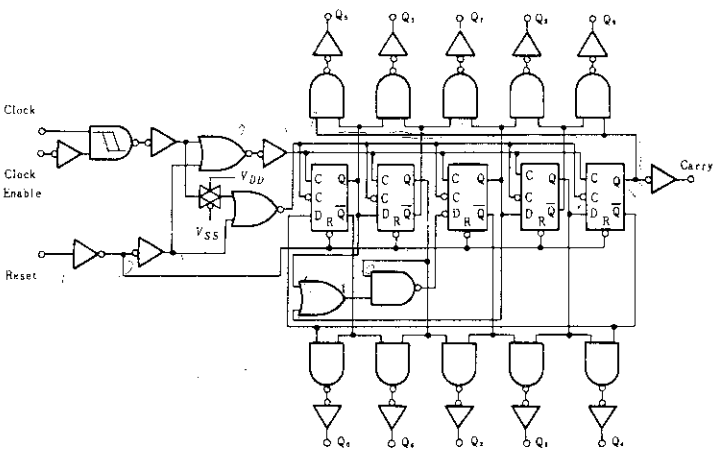
- Carry Output for Cascading 12MHz (typ) Operation @10V
- Divide-by-N Counting
- Quiescent Current = 5nA/pkg typ. @5V
- Supply Voltage Range = 3 to 18V
- Capable of Driving One Low-power Schottky TTL Load Over the Rated Temperature Range
- Pin-for-Pin Replacement for CD4017B and MC14017B

■ PIN ARRANGEMENT



(Top View)

■ LOGIC DIAGRAM



■ TRUTH TABLE

C	CE	R	Decode Output=n
0	×	0	n
×	1	0	n
×	×	1	Q_0
↑	0	0	n + 1
↓	×	0	n
×	↑	0	n
1	↓	0	n + 1

Notes) 1. × : Don't Care.
2. If n<5 Carry="1", Otherwise="0"

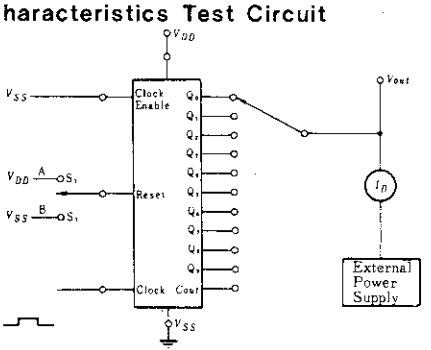
■ ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	V_{DD}(V)	Test Conditions	−40°C min	−40°C max	25°C min	25°C typ	25°C max	85°C min	85°C max	Unit
Output Voltage	V_{OL}	5.0	V_{in} = V_{DD} or 0	—	0.05	—	0	0.05	—	0.05	V
		10		—	0.05	—	0	0.05	—	0.05	
		15		—	0.05	—	0	0.05	—	0.05	
	V_{OH}	5.0	V_{in} = 0 or V_{DD}	4.95	—	4.95	5.0	—	4.95	—	V
		10		9.95	—	9.95	10	—	9.95	—	
		15		14.95	—	14.95	15	—	14.95	—	
Input Voltage	V_{IL}	5.0	V_{out} = 4.5 or 0.5V	—	1.5	—	2.25	1.5	—	1.5	V
		10	V_{out} = 9.0 or 1.0V	—	3.0	—	4.50	3.0	—	3.0	
		15	V_{out} = 13.5 or 1.5V	—	4.0	—	6.75	4.0	—	4.0	
	V_{IH}	5.0	V_{out} = 0.5 or 4.5V	3.5	—	3.5	2.75	—	3.5	—	V
		10	V_{out} = 1.0 or 9.0V	7.0	—	7.0	5.50	—	7.0	—	
		15	V_{out} = 1.5 or 13.5V	11.0	—	11.0	8.25	—	11.0	—	
Output Drive Current	I_{OH}	5.0	V_{OH} = 2.5V	−1.0	—	−0.8	−1.7	—	−0.6	—	mA
		5.0	V_{OH} = 4.6V	−0.2	—	−0.16	−0.36	—	−0.12	—	
		10	V_{OH} = 9.5V	−0.5	—	−0.4	−0.9	—	−0.3	—	
		15	V_{OH} = 13.5V	−1.4	—	−1.2	−3.5	—	−1.0	—	
	I_{OL}	5.0	V_{OL} = 0.4V	0.52	—	0.44	0.88	—	0.36	—	mA
		10	V_{OL} = 0.5V	1.3	—	1.1	2.25	—	0.9	—	
		15	V_{OL} = 1.5V	3.6	—	3.0	8.8	—	2.4	—	
Input Current	I_{in}	15		—	±0.3	—	±0.00001	±0.3	—	±1.0	μA
Input Capacitance	C_{in}	—	V_{in} = 0	—	—	—	5.0	7.5	—	—	pF
Quiescent Current	I_{DD}	5.0	Zero Signal, per Package	—	20	—	0.005	20	—	150	μA
		10		—	40	—	0.010	40	—	300	
		15		—	80	—	0.015	80	—	600	
Total Supply Current*	I_T	5.0	Dynamic + I_{DD}, C_L = 50pF, f = 1 kHz, per Gate	—	—	—	0.27	—	—	—	μA
		10		—	—	—	0.55	—	—	—	
		15		—	—	—	0.83	—	—	—	

* To calculate total supply current at frequency other than 1kHz.
@ V_{DD} = 5.0V $I_T = (0.27\mu A/kHz) f + I_{DD}$ @ V_{DD} = 10V $I_T = (0.55\mu A/kHz) f + I_{DD}$ @ V_{DD} = 15V $I_T = (0.83\mu A/kHz) f + I_{DD}$

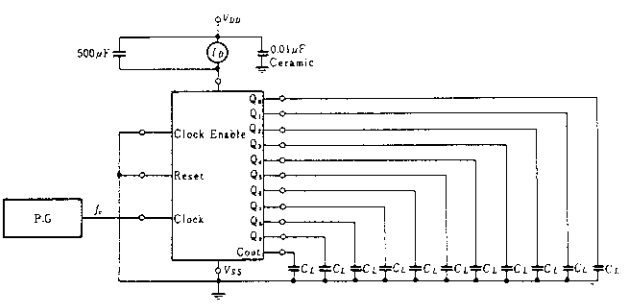
■ DC CHARACTERISTIC TEST CIRCUIT

● Typical Output Source and Output Sink Characteristics Test Circuit



	I_{OL}	I_{OH}
DECODE OUTPUTS	(S1 − A)	Clock to desired outputs (S1 to B)
Carry	Clock5 ~ 9(S1 ~ B)	S1 − A
V_{GS} =	V_{DD}	− V_{DD}
V_{DS} =	V_{out}	$V_{out} - V_{DD}$

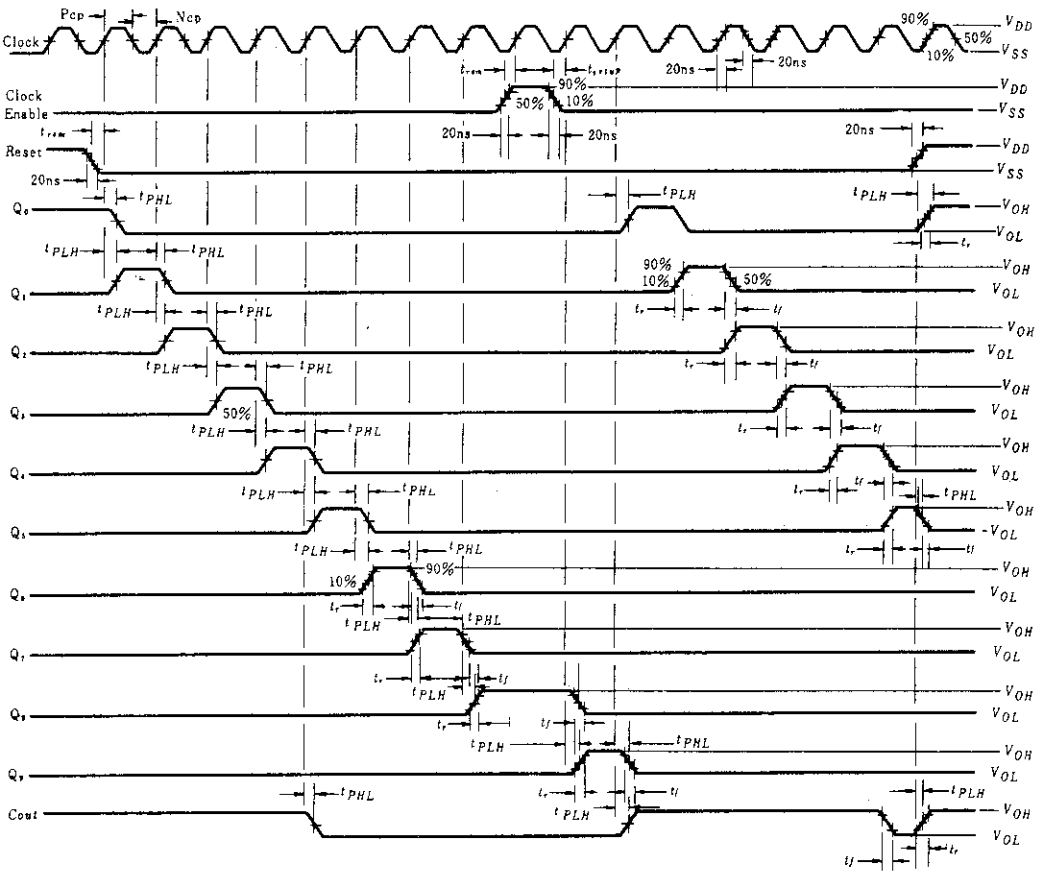
■ POWER DISSIPATION TEST CIRCUIT



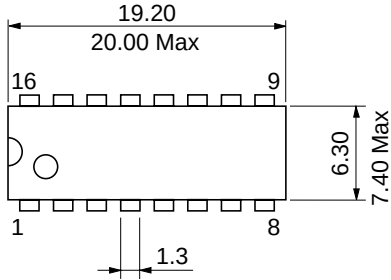
■ SWITCHING CHARACTERISTICS (C_L=50pF, Ta=25°C)

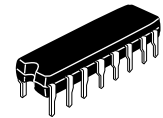
Characteristic		Symbol	V_{DD}(V)	min	typ	max	Unit
Output Rise Time		t_r	5.0	–	180	400	ns
			10	–	90	200	
			15	–	65	160	
Output Fall Time		t_f	5.0	–	100	200	ns
			10	–	50	100	
			15	–	37	80	
Propagation Delay Time	Reset-to-Decode	t_{PLH}, t_{PHL}	5.0	–	500	1000	ns
			10	–	230	460	
			15	–	140	350	
	Clock-to-Cout		5.0	–	400	800	
			10	–	150	350	
			15	–	100	250	
	Clock-to-Decode		5.0	–	500	1000	
			10	–	230	460	
			15	–	140	350	
	Reset-to-Cout	t_{PLH}	5.0	–	400	800	ns
			10	–	150	350	
			15	–	100	250	
Clock Pulse Width		PW_C	5.0	250	100	–	ns
			10	100	42	–	
			15	75	30	–	
Clock Pulse Frequency		PRF	5.0	–	5.0	2.0	MHz
			10	–	12	5.0	
			15	–	16	6.7	
Reset Pulse Width		PW_R	5.0	500	200	–	ns
			10	250	100	–	
			15	190	75	–	
Reset Removal Time		t_{rem}	5.0	750	300	–	ns
			10	275	100	–	
			15	210	80	–	
Clock Pulse Rise and Fall Time		t_r, t_f	5.0	No Limit			
			10				
			15				
Clock Enable Setup Time		t_{setup}	5.0	700	175	–	ns
			10	300	75	–	
			15	225	52	–	
Clock Enable Removal Time		t_{rem}	5.0	700	260	–	ns
			10	300	100	–	
			15	225	70	–	

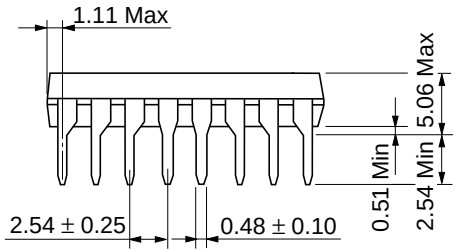
■ DYNAMIC SIGNAL WAVEFORMS

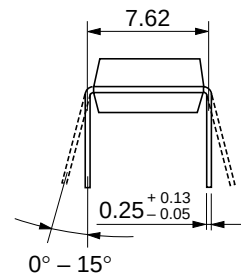


Unit: mm



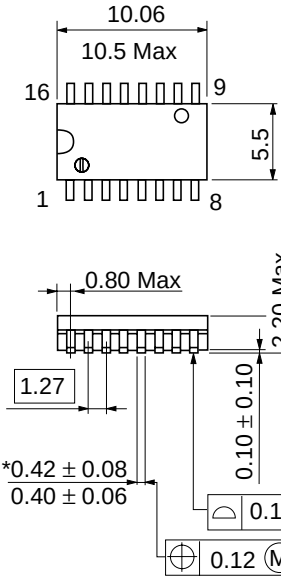


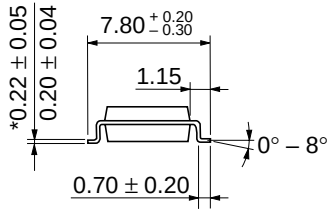


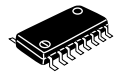


Hitachi Code	DP-16
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	1.07 g

Unit: mm



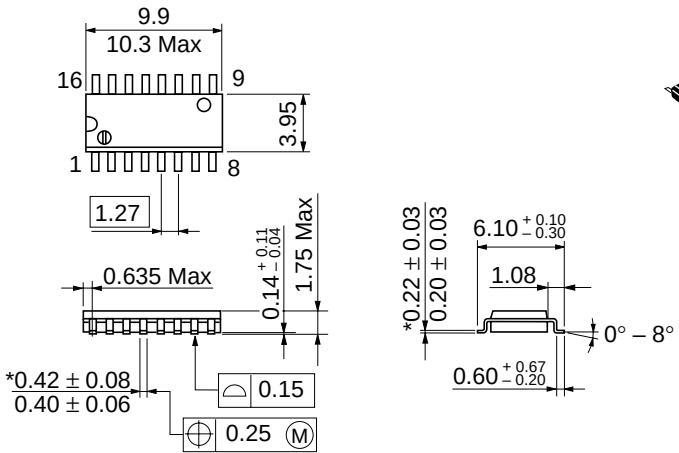




*Dimension including the plating thickness
Base material dimension

Hitachi Code	FP-16DA
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.24 g

Unit: mm



Hitachi Code	FP-16DN
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	0.15 g

*Dimension including the plating thickness
Base material dimension

Cautions

1. Hitachi neither warrants nor grants licenses of any rights of Hitachi's or any third party's patent, copyright, trademark, or other intellectual property rights for information contained in this document. Hitachi bears no responsibility for problems that may arise with third party's rights, including intellectual property rights, in connection with use of the information contained in this document.
2. Products and product specifications may be subject to change without notice. Confirm that you have received the latest product standards or specifications before final design, purchase or use.
3. Hitachi makes every attempt to ensure that its products are of high quality and reliability. However, contact Hitachi's sales office before using the product in an application that demands especially high quality and reliability or where its failure or malfunction may directly threaten human life or cause risk of bodily injury, such as aerospace, aeronautics, nuclear power, combustion control, transportation, traffic, safety equipment or medical equipment for life support.
4. Design your application so that the product is used within the ranges guaranteed by Hitachi particularly for maximum rating, operating supply voltage range, heat radiation characteristics, installation conditions and other characteristics. Hitachi bears no responsibility for failure or damage when used beyond the guaranteed ranges. Even within the guaranteed ranges, consider normally foreseeable failure rates or failure modes in semiconductor devices and employ systemic measures such as fail-safes, so that the equipment incorporating Hitachi product does not cause bodily injury, fire or other consequential damage due to operation of the Hitachi product.
5. This product is not designed to be radiation resistant.
6. No one is permitted to reproduce or duplicate, in any form, the whole or part of this document without written approval from Hitachi.
7. Contact Hitachi's sales office for any questions regarding this document or Hitachi semiconductor products.

HITACHI

Hitachi, Ltd.
Semiconductor & Integrated Circuits.
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

URL
NorthAmerica : http:semiconductor.hitachi.com/
Europe : http://www.hitachi-eu.com/hel/ecg
Asia (Singapore) : http://www.has.hitachi.com.sg/grp3/sicd/index.htm
Asia (Taiwan) : http://www.hitachi.com.tw/E/Product/SICD_Frame.htm
Asia (HongKong) : http://www.hitachi.com.hk/eng/bo/grp3/index.htm
Japan : http://www.hitachi.co.jp/Sicd/indx.htm

For further information write to:

Hitachi Semiconductor
(America) Inc.
179 East Tasman Drive,
San Jose,CA 95134
Tel: <1> (408) 433-1990
Fax: <1>(408) 433-0223

Hitachi Europe GmbH
Electronic components Group
Dornacher Straße 3
D-85622 Feldkirchen, Munich
Germany
Tel: <49> (89) 9 9180-0
Fax: <49> (89) 9 29 30 00

Hitachi Europe Ltd.
Electronic Components Group.
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA, United Kingdom
Tel: <44> (1628) 585000
Fax: <44> (1628) 778322

Hitachi Asia Pte. Ltd.
16 Collyer Quay #20-00
Hitachi Tower
Singapore 049318
Tel: 535-2100
Fax: 535-1533

Hitachi Asia Ltd.
Taipei Branch Office
3F, Hung Kuo Building. No.167,
Tun-Hwa North Road, Taipei (105)
Tel: <886> (2) 2718-3666
Fax: <886> (2) 2718-8180

Hitachi Asia (Hong Kong) Ltd.
Group III (Electronic Components)
7/F., North Tower, World Finance Centre,
Harbour City, Canton Road, Tsim Sha Tsui,
Kowloon, Hong Kong
Tel: <852> (2) 735 9218
Fax: <852> (2) 730 0281
Telex: 40815 HITEC HX