HD14541B

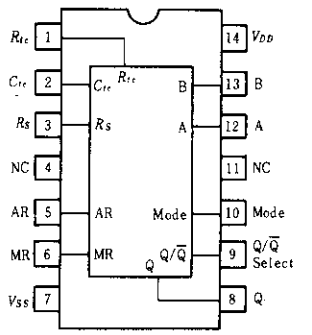
Programmable Oscillator/Timer

The HD14541B programmable timer consists of a 16-stage binary counter, an integrated oscillator for use with an external capacitor and two resistors, an automatic power-on reset circuit, and output control logic. Timing is initialized by turning on power, whereupon the power-on reset is enabled and initializes the counter, within the specified V_{DD} range. With the power already on, an external reset pulse can be applied. Upon release of the initial reset command, the oscillator will oscillate with a frequency determined by the external RC network. The 16-stage counter divides the oscillator frequency (f_{osc}) with the n^{th} stage frequency being $f_{osc}/2^n$.

■ FEATURES

- Available Outputs 2^8, 2^{10}, 2^{13} or 2^{16}
- Increments on Positive Edge Clock Transitions
- Low Symmetrical Output Resistance (typically 100Ω @15V)
- Built-in Low Power RC Oscillator (±2% accuracy over temperature range and ±10% supply and ±3% over processing @ < 10kHz)
- Oscillator Frequency Range = DC to 100kHz
- Oscillator May Be Bypassed if External Clock is Available (Apply external clock to Pin 3)
- Automatic Reset Initializes All Counters When Power Turns On (Limits-V_{DD} from 8.5V to 18V when enabled)
- External Master Reset Totally Independent of Automatic Reset Operation
- Operates as 2^n Frequency Divider or Single Transition Timer
- Q/Q Select Provides Output Logic Level Flexibility
- Reset (auto or master) Disables Oscillator During Resetting to Provide No Active Power Dissipation
- Clock Conditioning Circuit Permits Operation with Very Slow Clock Rise and Fall Times
- Supply Voltage Range = 3 to 18V

■ PIN ARRANGEMENT



(Top View)

■ TRUTH TABLE

Pin	State	
	0	1
5	Auto Reset Operating	Auto Reset Disabled
6	Timer Operational	Master Reset ON
9	Output Initially Low After Reset	Output Initially High After Reset
10	Single Cycle Mode	Recycle Mode

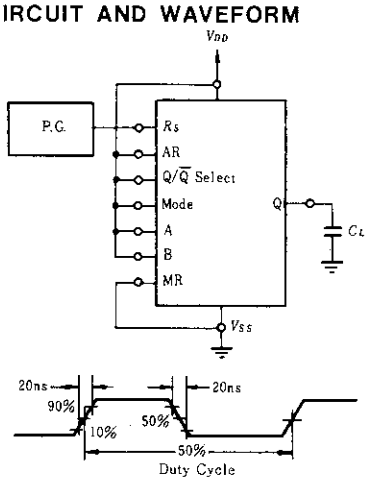
■ FREQUENCY SELECTTION TABLE

A	B	Number of Counter Stages	Count 2^n
0	0	13	8192
0	1	10	1024
1	0	8	256
1	1	16	65536

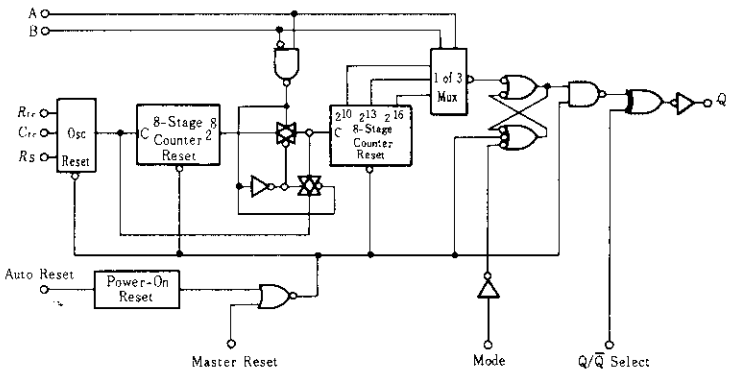
■ MAXIMUM RATINGS (Voltages referenced to V_{SS})

Characteristic	Symbol	Value	Unit
DC Supply Voltage	V_{DD}	−0.5~+18	V
Input/Output Voltage	V_{in}, V_{out}	−0.5~V_{DD}+0.5	V
DC Current Drain per Input Pin	I_{in}	±10	mA
DC Current Drain per Output Pin	I_{OL}, I_{OH}	±45	mA
Operating Temperature Range	T_A	−40~+85	℃
Storage Temperature Range	T_{stg}	−65~+150	℃
Power Dissipation	P_D	300	mW

● POWER DISSIPATION TEST CIRCUIT AND WAVEFORM



■ BLOCK DIAGRAM

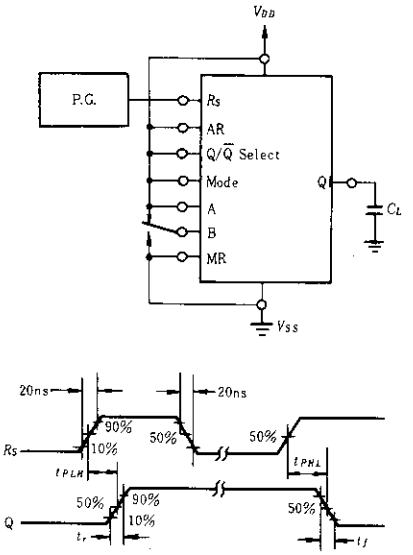


■ ELECTRICAL CHARACTERISTICS

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	$V_{OH}=2.5$V	−5.1	—	−4.27	−12.83	—	−3.5	—	mA
		10	$V_{OH}=9.5$V	−2.69	—	−2.25	−6.75	—	−1.85	—	
		15	$V_{OH}=13.5$V	−10.5	—	−8.8	−26.33	—	−7.22	—	
	I_{OL}	5.0	$V_{OL}=0.4$V	1.24	—	1.04	3.12	—	0.85	—	mA
		10	$V_{OL}=0.5$V	3.18	—	2.66	8.0	—	2.18	—	
		15	$V_{OL}=1.5$V	12.4	—	10.4	31.2	—	8.50	—	
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	
Auto Reset Quiescent Current	I_{DDR}	5.0	Pin 5 is low	—	200	—	7	200	—	1200	μA
		10		—	250	—	30	250	—	1500	
		15		—	500	—	82	500	—	2000	
Total Supply Current*	I_T	5.0	Dynamic $+I_{DD}$, per Gate C_L=50pF, f=1kHz	—	—	—	0.4	—	—	—	μA
		10		—	—	—	0.8	—	—	—	
		15		—	—	—	1.2	—	—	—	

* To calculate total supply current at frequency other than 1kHz.
@V_{DD}=5.0V $I_T=(0.4\,\mu A/kHz)f+I_{DD}$, @$V_{DD}$=10V $I_T=(0.8\,\mu A/kHz)f+I_{DD}$, @$V_{DD}$=15V $I_T=(1.2\,\mu A/kHz)f+I_{DD}$

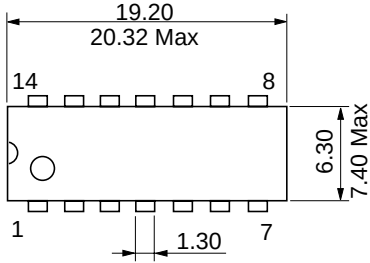
■ SWITCHING TIME TEST CIRCUIT

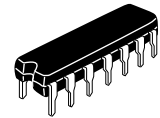


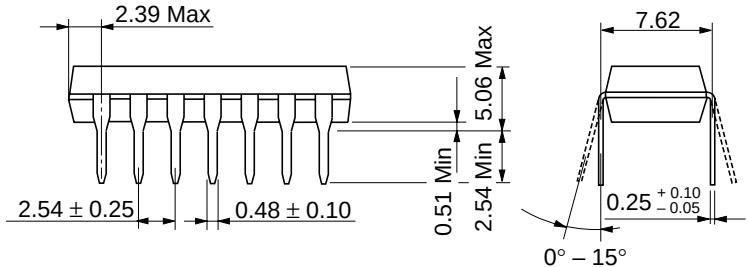
■ SWITCHING CHARACTERISTICS (C_L=50pF, Ta=25°C)

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	Clock to Q (2^8 Output)	t_{PLH}, t_{PHL}	5.0	—	3.5	10.5	μs
			10	—	1.25	3.8	
			15	—	0.9	2.9	
	Clock to Q (2^{16} Output)		5.0	—	6.0	18	
			10	—	3.5	10	
			15	—	2.5	7.5	
Clock Pulse Width		PW_C	5.0	900	300	—	ns
			10	300	100	—	
			15	225	85	—	
Clock Frequency		PRF	5.0	—	1.5	—	MHz
			10	—	4.0	—	
			15	—	6.0	—	
Minimum Master Reset Pulse Width		PW_{MR}	5.0	900	300	—	ns
			10	300	100	—	
			15	225	85	—	

Unit: mm







Hitachi Code	DP-14
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	0.97 g

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