

HD14553B

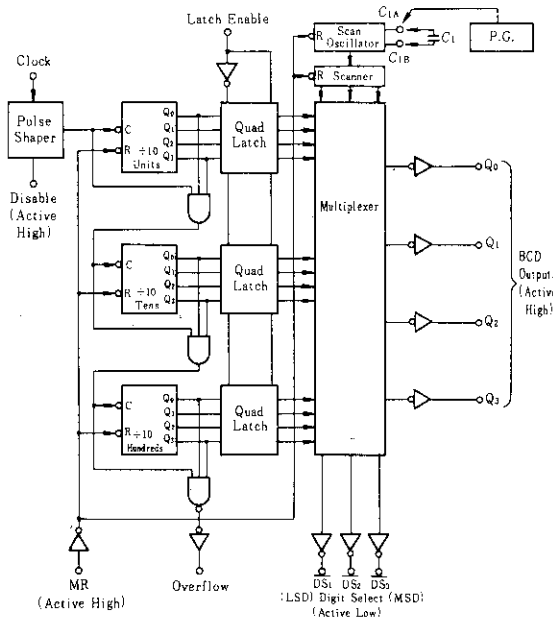
Three-Digit BCD Counter

The HD14553B three-digit BCD counter consists of three negative-edge triggered BCD counters that are cascaded synchronously. A quad latch at the output of each counter permits storage of any given count. The information is then time division multiplexed, providing on BCD number or digit at a time. Digit select outputs provide display control. All outputs are TTL compatible. An on-chip oscillator provides the low-frequency scanning clock which drives the multiplexer output selector. This device is used in instrumentation counters, clock displays, digital panel meters, and as a building block for general logic applications.

FEATURES

- TTL Outputs
- On-Chip Oscillator
- Cascadable
- Clock Disable Input
- Pulse Shaping Permits Very Slow Rise Times on Input Clock
- Output Latches
- Master Reset

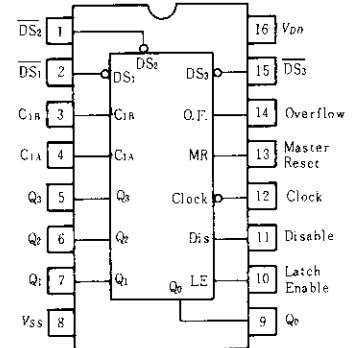
BLOCK DIAGRAM



MAXIMUM RATINGS (Voltages refeeced to V_{SS})

Characteristic	Symbol	Value	Unit
DC Supply Voltage	V_{DD}	$-0.5 \sim +18$	V
Input/Output Voltage	V_{in}, V_{out}	$-0.5 \sim V_{DD} + 0.5$	V
DC Current Drain per Input Pin	I_{in}	± 10	mA
DC Current per Pin, All Outputs	I_{out}	20	mA
Operating Temperature Range	T_A	$-40 \sim +85$	$^{\circ}\text{C}$
Storage Temperature Range	T_{stg}	$-65 \sim +150$	$^{\circ}\text{C}$
Power Dissipation	P_D	300	mW

PIN ARRANGEMENT



(Top View)

TRUTH TABLE

Inputs				Outputs
MR	Clock	Disable	LE	
0	0	0	0	No Change
0	1	0	0	Advance
0	x	1	x	No Change
0	1	1	0	Advance
0	1	0	1	No Change
0	0	x	x	No Change
0	x	x	0	Latched
0	x	x	1	Latched
1	x	x	0	$Q_0 \sim Q_3 = 0$

x = Don't Care

ELECTRICAL CHARACTERISTICS

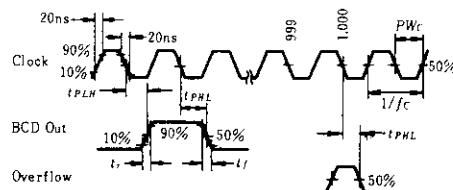
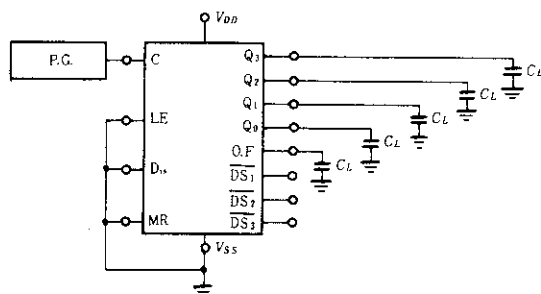
Characteristic	Symbol	$V_{DD}(V)$	Test Conditions	-40°C		25°C			85°C		Unit
				min	max	min	typ	max	min	max	
Output Voltage	V_{OL}	5.0	$V_{in} = V_{DD}$ or 0	—	0.05	—	0	0.05	—	0.05	V
		10		—	0.05	—	0	0.05	—	0.05	
		15		—	0.05	—	0	0.05	—	0.05	
	V_{OH}	5.0	$V_{in} = 0$ or V_{DD}	4.95	—	4.95	5.0	—	4.95	—	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	$V_{OH} = 4.6V$	-0.2	—	-0.16	-0.36	—	-0.12	—	mA
		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	—	
	Pin 3 Other Outputs	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	
		I_{OL}	5.0	$V_{OL} = 0.4V$	2.4	—	2.0	4.0	—	1.6	
			10	$V_{OL} = 0.5V$	3.8	—	3.0	8.0	—	2.5	
			15	$V_{OL} = 1.5V$	10	—	8.4	20	—	7.0	
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	—	50	—	0.010	50	—	375	μA
		10		—	100	—	0.020	100	—	750	
		15		—	200	—	0.030	200	—	1500	
Total Supply Current*	I_T	5.0	Dynamic + I_{DD} ,	—	—	—	0.35	—	—	—	μA
		10	per Gate	—	—	—	0.85	—	—	—	
		15	$C_L = 50pF, f = 1kHz$	—	—	—	1.50	—	—	—	

* To calculate total supply current at frequency other than 1kHz.

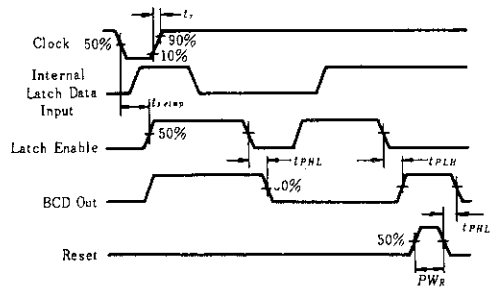
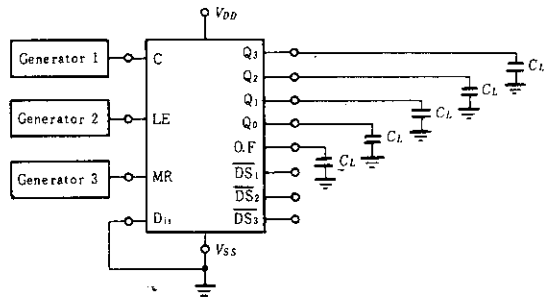
@ $V_{DD} = 5.0V$ $I_T = (0.35 \mu A/kHz)f + I_{DD}$, @ $V_{DD} = 10V$ $I_T = (0.85 \mu A/kHz)f + I_{DD}$, @ $V_{DD} = 15V$ $I_T = (1.50 \mu A/kHz)f + I_{DD}$

SWITCHING TIME TEST CIRCUIT

1.



2.

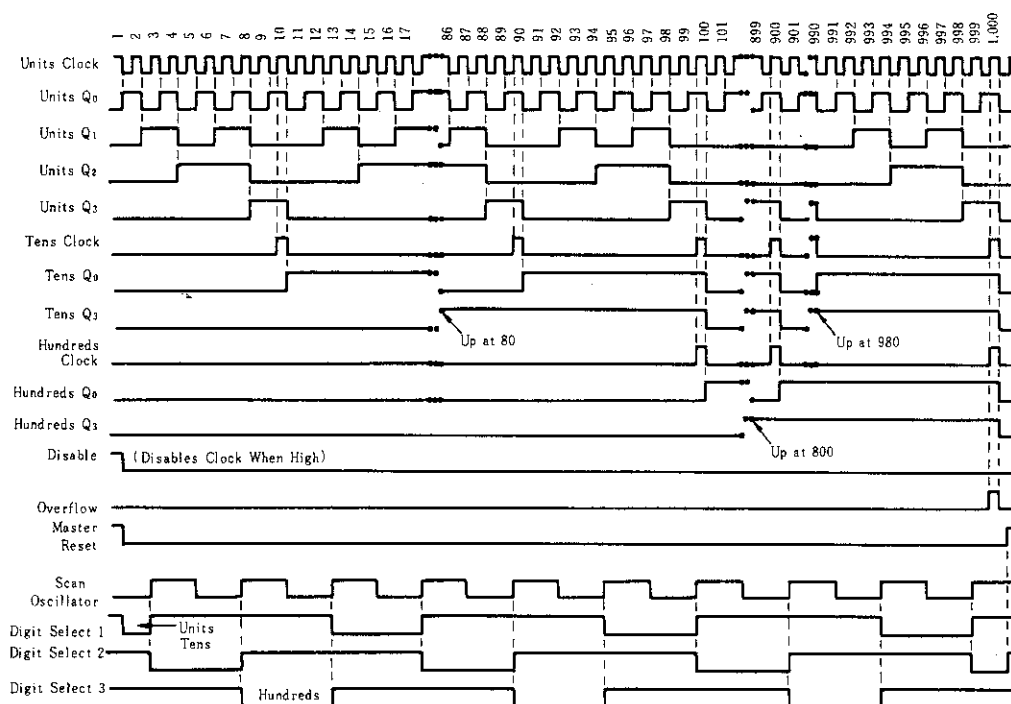


■SWITCHING CHARACTERISTICS ($C_L=50\text{pF}$, $T_a=25^\circ\text{C}$)

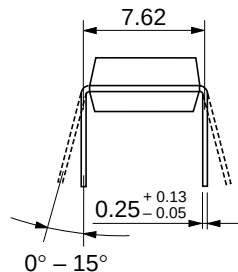
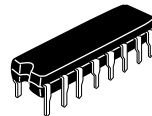
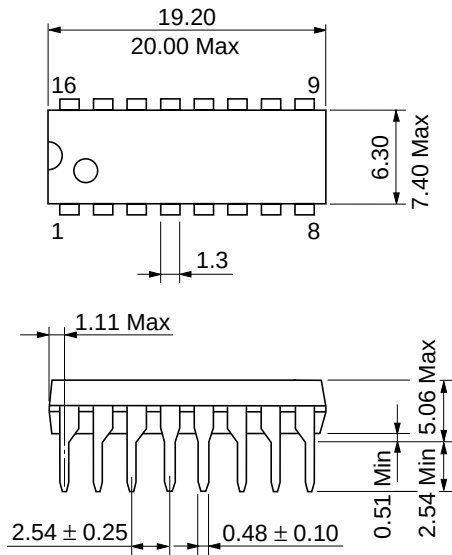
Characteristic		Symbol	Test Circuit	$V_{DD}(\text{V})$	min	typ	max	Unit
Output Rise Time		t_r	1	5.0	—	180	400	ns
				10	—	90	200	
				15	—	65	160	
Output Fall Time		t_f	1	5.0	—	120	250	ns
				10	—	60	125	
				15	—	40	100	
Propagation Delay Time	Clock to BCD Out	t_{PLR}, t_{PHL}	1	5.0	—	900	2000	ns
				10	—	500	1000	
				15	—	300	750	
	Clock to Overflow	t_{PHL}	1	5.0	—	600	1300	ns
				10	—	400	800	
				15	—	200	600	
	Reset to BCD Out	t_{PHL}	2	5.0	—	900	2000	ns
				10	—	500	1000	
				15	—	300	750	
Setup Time		t_{setup}	2	5.0	900	300	—	ns
				10	500	200	—	
				15	375	100	—	
Clock Pulse Width		PW_C	1	5.0	550	275	—	ns
				10	200	100	—	
				15	150	75	—	
Reset Pulse Width		PW_R	2	5.0	1200	600	—	ns
				10	600	300	—	
				15	450	225	—	
Clock Frequency		f_C	1	5.0	—	1.5	0.7	MHz
				10	—	5.0	2.0	
				15	—	7.0	2.5	
Input Clock Rise Time		t_r	2	5.0	No Limit			
				10				
				15				
Scon Oscillator Frequency		f_{osc}		5.0	—	$0.4/C_1^*$	—	Hz
				10	—	$1.2/C_1^*$	—	
				15	—	$1.6/C_1^*$	—	

* $C_1 = \mu\text{F}$

● TIMING DIAGRAM



Unit: mm



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

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