HD14553B

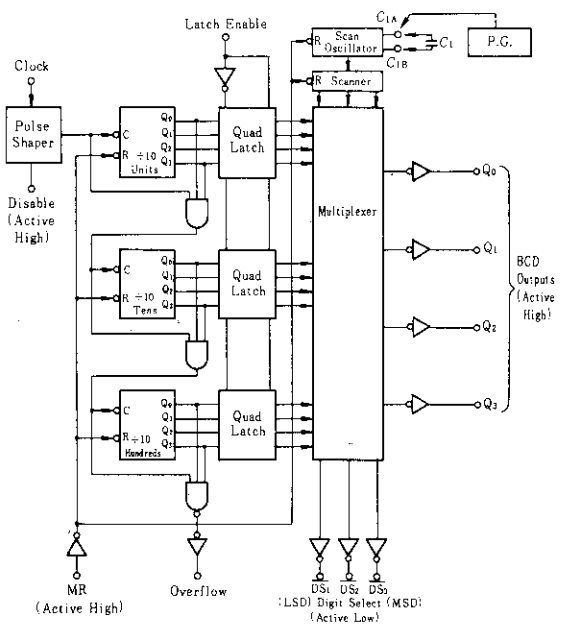
Three-Digit BCD Counter

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 clock for general logic applications.

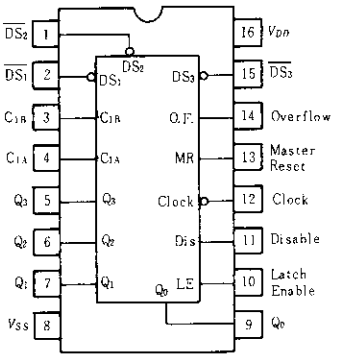
■ FEATURES

- 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



■ PIN ARRANGEMENT



(Top View)

■ TRUTH TABLE

Inputs				Outputs
MR	Clock	Disable	LE	
0	↑	0	0	No Change
0	↓	0	0	Advance
0	×	1	×	No Change
0	1	↑	0	Advance
0	1	↓	0	No Change
0	0	×	×	No Change
0	×	×	↑	Latched
0	×	×	1	Latched
1	×	×	0	Q_0~Q_3=0

x=Don't Care

■ MAXIMUM RATINGS (Voltages refeoced 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 per Pin, All Outputs	I_{out}	20	mA
Operating Temperature Range	T_A	−40~+85	°C
Storage Temperature Range	T_{stg}	−65~+150	°C
Power Dissipation	P_D	300	mW

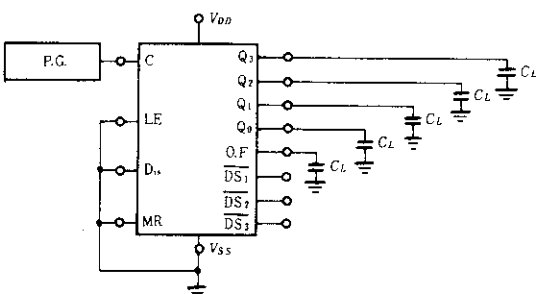
■ ELECTRICAL CHARACTERISTICS

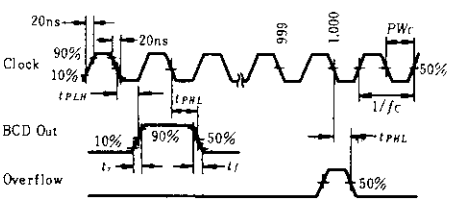
Characteristic		Symbol	V_{DD}(V)	Test Conditions	−40°C min	−40°C max	25°C min	25°C typ	25°C max	85°C min	85°C max	Unit
Output Voltage		V_{OL}	5.0	$V_{in}=V_{DD}$ or 0	—	0.05	—	0	0.05	—	0.05	V
			10		—	0.05	—	0	0.05	—	0.05	
			15		—	0.05	—	0	0.05	—	0.05	
		V_{OH}	5.0	$V_{in}=0$ or V_{DD}	4.95	—	4.95	5.0	—	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	$V_{OH}=4.6$V	−0.2	—	−0.16	−0.36	—	−0.12	—	mA
			10	$V_{OH}=9.5$V	−0.5	—	−0.4	−0.9	—	−0.3	—	
			15	$V_{OH}=13.5$V	−1.4	—	−1.2	−3.5	—	−1.0	—	
	Pin 3	I_{OL}	5.0	$V_{OL}=0.4$V	0.52	—	0.44	0.88	—	0.36	—	mA
			10	$V_{OL}=0.5$V	1.3	—	1.1	2.25	—	0.9	—	
			15	$V_{OL}=1.5$V	3.6	—	3.0	8.8	—	2.4	—	
	Other Outputs		5.0	$V_{OL}=0.4$V	2.4	—	2.0	4.0	—	1.6	—	
			10	$V_{OL}=0.5$V	3.8	—	3.0	8.0	—	2.5	—	
			15	$V_{OL}=1.5$V	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}, per Gate $C_L=50$pF, $f=1$ kHz	—	—	—	0.35	—	—	—	μA
			10		—	—	—	0.85	—	—	—	
			15		—	—	—	1.50	—	—	—	

* To calculate total supply current at frequency other than 1kHz.
@$V_{DD}=5.0$V $I_T=(0.35\,\mu A/kHz)f+I_{DD}$, @$V_{DD}=10$V $I_T=(0.85\,\mu A/kHz)f+I_{DD}$, @$V_{DD}=15$V $I_T=(1.50\,\mu A/kHz)f+I_{DD}$

■ SWITCHING TIME TEST CIRCUIT

1.





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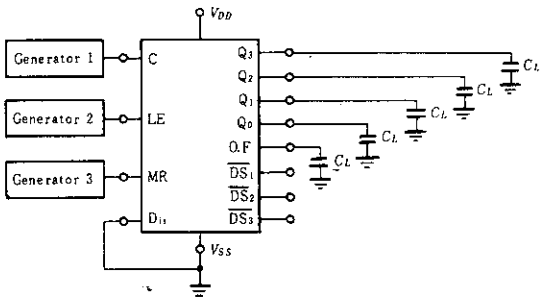
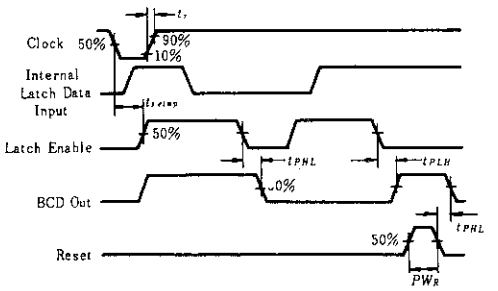


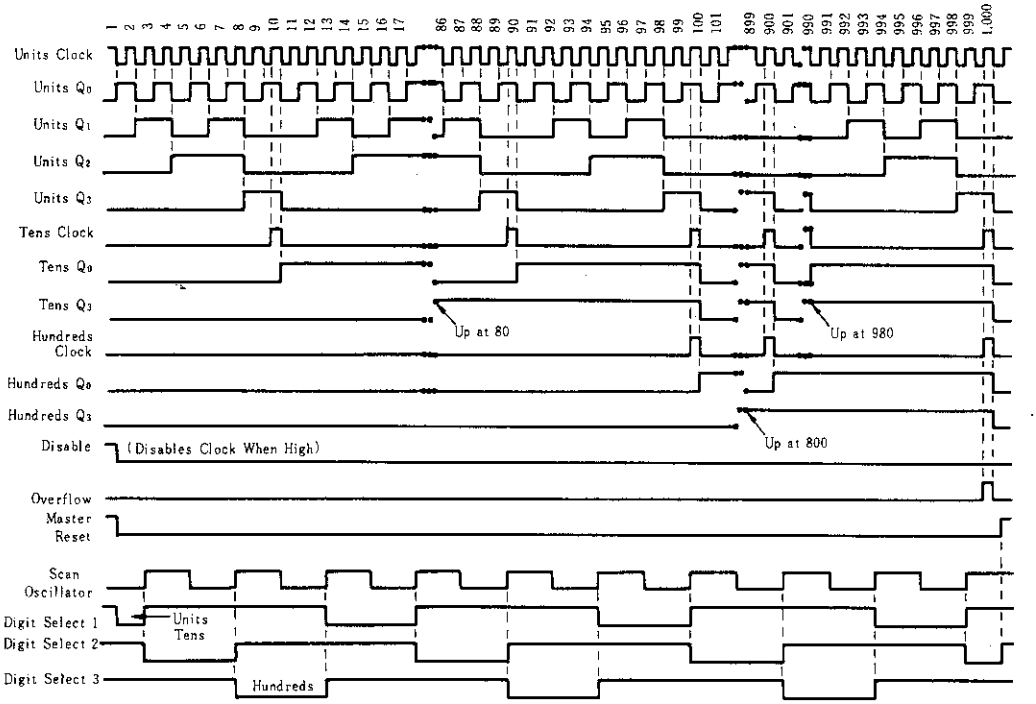


■SWITCHING CHARACTERISTICS (C_L=50pF, Ta=25°C)

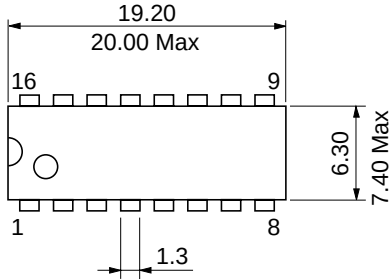
Characteristic		Symbol	Test Circuit	V_{DD}(V)	min	typ	max	Unit
Output Rise Time		t_r	1	5.0	—	180	400	ns
				10	—	90	200	
				15	—	65	160	
Output Fall Time		t_f	1	5.0	—	120	250	ns
				10	—	60	125	
				15	—	40	100	
Propagation Delay Time	Clock to BCD Out	t_{PLH}, t_{PHL}	1	5.0	—	900	2000	ns
				10	—	500	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*	—	

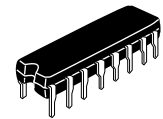
* C_1 = μF

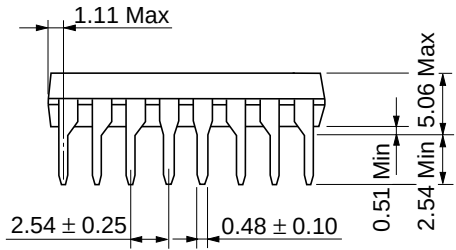
● TIMING DIAGRAM

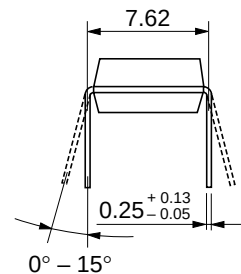


Unit: mm









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