

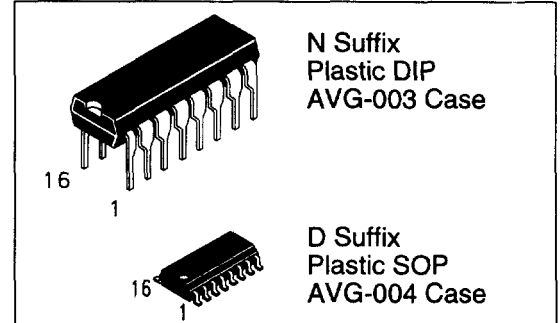
Technical Data

DV74AC161, DV74AC163 Available Q2, 1995

Synchronous Presetable Binary Counter

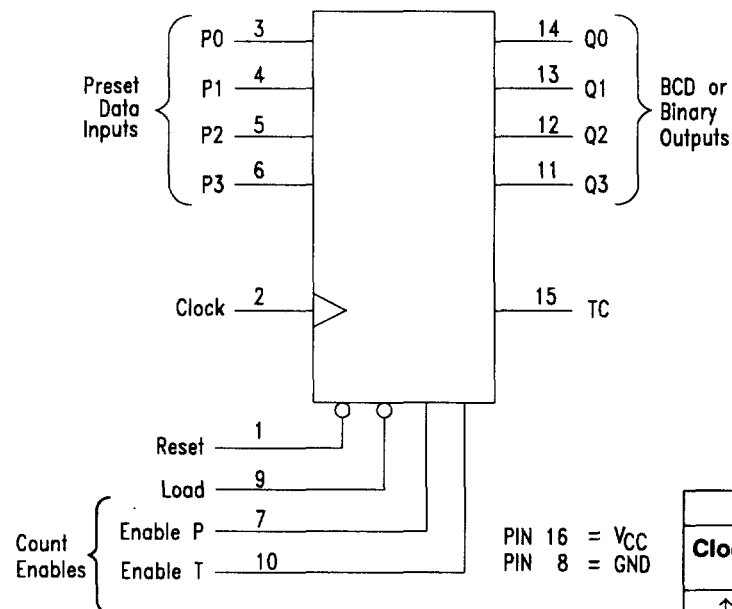
These devices are high-speed synchronous modulo-16 binary counters. They are synchronously presetable for application in programmable dividers and have two types of Count Enable inputs plus a Terminal Count output for versatility in forming synchronous multistage counters. The DV74AC161 and the DV74ACT161 have an asynchronous Master Reset input that overrides all other inputs and forces the outputs LOW. The DV74AC163 and the DV74ACT163 have a Synchronous Reset input that overrides counting and parallel loading and allows the outputs to be simultaneously reset on the rising edge of the clock.

DV74AC161
DV74ACT161
DV74AC163
DV74ACT163



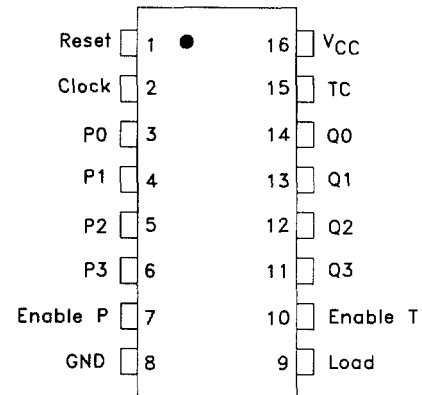
- Advanced very high speed CMOS
- Outputs source/sink 24 mA
- Transmission line driving 50 ohms
- ACT has TTL compatible inputs
- Operation from 2 to 6 volts guaranteed
- DC & AC Parameters guaranteed over -40 to +85°C

LOGIC DIAGRAM



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PIN ASSIGNMENT



TRUTH TABLE

Inputs					Action on the Rising Clock Edge
Clock	Reset*	Load	Enable T	Enable P	
↑	L	X	X	X	Reset (Clear)
↑	H	L	X	X	Load (P _n → Q _n)
↑	H	H	H	H	Count (Increment)
↑	H	H	L	X	No Change (Hold)
↑	H	H	X	L	No Change (Hold)

*AC163 only, AC161 is asynchronous-reset device

H=HIGH Voltage Level

L=LOW Voltage Level

X=Either Low or High Logic Level

ABSOLUTE MAXIMUM RATINGS

Maximum ratings are those values beyond which damage to the device may occur.

Symbol	Parameter	AC161-163, ACT161-163	Unit
V _{CC}	DC Supply Voltage (Referenced to GND)	- 0.5 to +7.0	V
V _{IN}	DC Input Voltage (Referenced to GND)	- 0.5 to V _{CC} +0.5	V
V _{OUT}	DC Output Voltage (Referenced to GND)	- 0.5 to V _{CC} +0.5	V
I _{IN}	DC Input Current, per Pin	± 20	mA
I _{OUT}	DC Output Sink/Source Current, per Pin	± 50	mA
I _{CC}	DC V _{CC} or GND Current per Output Pin	± 50	mA
T _{STG}	Storage Temperature	- 65 to +150	°C

GUARANTEED OPERATING CONDITIONS

Symbol	Parameter	Min	Typ	Max	Unit	
V _{CC}	Supply Voltage	'AC	2.0	5.0	6.0	V
		'ACT	4.5	5.0	5.5	
V _{IN} , V _{OUT}	DC Input Voltage, Output Voltage, (Ref. to GND)	0		V _{CC}	V	
t _r , t _f	Input Rise and Fall Time (Note 1) AC Devices	V _{CC} @ 3.0 V			150	ns/V
		V _{CC} @ 4.5 V			40	ns/V
		V _{CC} @ 5.5 V			25	ns/V
t _r , t _f	Input Rise and Fall Time (Note 2) ACT Devices	V _{CC} @ 4.5 V			10	ns/V
		V _{CC} @ 5.5 V			8.0	ns/V
T _A	Operating Ambient Temperature Range	-40		85	°C	
C _{IN}	Input Capacitance	V _{CC} = 5.0 V		4.5	pF	
C _{PD}	Power Dissipation Capacitance	V _{CC} = 5.0 V		45	pF	

1. V_{IN} from 30% to 70% V_{CC}

2. V_{IN} from 0.8 to 2.0 V

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DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V _{CC} (V)	AC161-163			Unit	
				T _A = +25°C		T _A = -40 to +85°C		
				Typ	Guaranteed Limits			
V _{IH}	Minimum High Level Input Voltage	V _{OUT} = 0.1V or V _{CC} - 0.1 V	3.0	1.5	2.1	2.1	V	
			4.5	2.25	3.15	3.15		
			5.5	2.75	3.85	3.85		
V _{IL}	Maximum Low Level Input Voltage	V _{OUT} = 0.1V or V _{CC} - 0.1 V	3.0	1.5	0.9	0.9	V	
			4.5	2.25	1.35	1.35		
			5.5	2.75	1.65	1.65		
V _{OH}	Minimum High Level Output Voltage	I _{OUT} = -50 μA	3.0	2.99	2.9	2.9	V	
			4.5	4.49	4.4	4.4		
			5.5	5.49	5.4	5.4		
		V _{IN} = V _{IL} or V _{IH}	-12mA	3.0		2.56	2.46	V
			I _{OH} -24mA	4.5		3.86	3.76	
		-24 mA	5.5		4.86	4.76		

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Symbol	Parameter	Conditions	V _{CC} (V)	AC161-163			Unit
				T _A = +25°C		T _A = -40 to +85°C	
				Typ	Guaranteed Limits		
V _{OL}	Maximum Low Level Output Voltage	I _{OUT} = 50 μA	3.0	0.002	0.1	0.1	V
			4.5	0.001	0.1	0.1	
		V _{IN} = V _{IL} or V _{IH}					
		12mA	3.0		0.36	0.44	V
		I _{OH} 24mA	4.5		0.36	0.44	
		24 mA	5.5		0.36	0.44	
I _{IN}	Maximum Input Leakage Current	V _I = V _{CC} , GND	5.5		±0.1	±1.0	μA
I _{CC}	Maximum Quiescent Supply Current	V _{IN} = V _{CC} or GND	5.5		8.0	80	μA

AC CHARACTERISTICS

Symbol	Parameter (C _L = 50 pF)	V _{CC} ±10% (V)	AC161				AC163				Unit
			T _A = +25°C		T _A = -40°C to +85°C		T _A = +25°C		T _A = -40°C to +85°C		
			Min	Max	Min	Max	Min	Max	Min	Max	
f _{max}	Maximum Count Frequency	3.3 5.0	70 110		60 95		70 110		60 95		
t _{PLH}	Propagation Delay Clock to Q _n (Load Input HIGH or LOW)	3.3	2.0	12.0	1.5	13.5	2.0	12.5	1.5	13.5	ns
t _{PHL}		5.0	1.5	9.0	1.0	9.5	1.5	9.0	1.0	9.5	
t _{PLH}	Propagation Delay Clock to Ripple Carry Out	3.3	1.5	12.0	1.5	13.0	1.5	12.0	1.5	13.0	ns
t _{PHL}		5.0	1.5	9.0	1.5	10.0	1.5	9.5	1.5	10.0	
t _{PLH}	Propagation Delay Clock to Ripple Carry Out	3.3	3.0	15.0	2.5	16.5	3.0	15	2.5	16.5	ns
t _{PHL}		5.0	2.0	10.5	1.5	11.5	2.0	10.5	1.5	11.5	
t _{PLH}	Propagation Delay Enable T to Ripple Carry Out	3.3	2.0	9.5	1.5	11.0	2.0	9.5	1.5	11.0	ns
t _{PHL}		5.0	1.5	6.5	1.0	7.5	1.5	6.5	1.0	7.5	
t _{PLH}	Propagation Delay Master Reset to Q _n	3.3	2.0	12	1.5	13.5	74AC161 Only				ns
t _{PHL}		5.0	1.5	9.5	1.5	10.0	74AC161 Only				
t _{PLH}	Propagation Delay Master Reset to Ripple Carry Out	3.3	3.5	15	3.0	17.5	74AC161 Only				ns
t _{PHL}		5.0	2.5	13	2.5	13.5	74AC161 Only				

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AC OPERATING REQUIREMENTS

Symbol	Parameter	V _{CC} ±10% V	AC161		AC163		Unit
			T _A = +25°C	T _A = -40°C to +85°C	T _A = +25°C	T _A = -40°C to +85°C	
			Minimum		Minimum		
t _s	Setup Time, HIGH or LOW P _n to Clock	3.3	13.5	16.0	13.5	16.0	ns
		5.0	8.5	10.5	8.5	10.5	
t _h	Hold Time, HIGH or LOW P _n to Clock	3.3	-1.0	-0.5	-1.0	-0.5	ns
		5.0	0	0	0	0	
t _s	Setup Time, HIGH or LOW Load to Clock	3.3	11.5	14	14.0	1635	ns
		5.0	7.5	8.5	9.5	11.0	
t _h	Hold Time, HIGH or LOW Load to Clock	3.3	0	0	-1.0	-0.5	ns
		5.0	0.5	1.0	-0.5	0	
t _s	Setup Time, HIGH or LOW Enable P or Enable T to Clock	3.3	6.0	7.0	6.0	7.0	ns
		5.0	4.5	5.0	4.5	5.0	
t _h	Hold Time, HIGH or LOW Enable P or Enable T to Clock	3.3	0	0	0	0	ns
		5.0	0	0.5	0	0.5	

Symbol	Parameter	V _{CC} ±10% V	ACT161		ACT163		Unit
			T _A = +25°C	T _A = -40°C to +85°C	T _A = +25°C	T _A = -40°C to +85°C	
			Minimum		Minimum		
t _w	Clock Pulse Width (Load) HIGH or LOW	3.3 5.0	3.5 2.5	4.0 3.0	3.5 2.5	4.0 3.0	ns
t _w	Clock Pulse Width (Count) HIGH or LOW	3.3 5.0	4.0 3.0	4.5 3.5	3.5 2.5	4.0 3.0	ns
t _w	Master Reset Pulse Width, LOW	3.3 5.0	5.5 4.5		7.5 6.0		ns
t _{rec}	Recovery Time Master Reset to Clock	3.3 5.0	-0.5 0		0 0.5		ns

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DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V _{CC} (V)	ACT161, ACT163			Unit
				T _A = +25°C		T _A = -40 to +85°C	
				Typ	Guaranteed Limits		
V _{IH}	Minimum High Level Input Voltage	V _{OUT} = 0.1V or V _{CC} - 0.1 V	4.5 5.5	1.5 1.5	2.0 2.0	2.0 2.0	V
V _{IL}	Maximum Low Level Input Voltage	V _{OUT} = 0.1V or V _{CC} - 0.1 V	4.5 5.5	1.5 1.5	0.8 0.8	0.8 0.8	V
V _{OH}	Minimum High Level Output Voltage	I _{OUT} = -50 μA	4.5 5.5	4.49 5.49	4.4 5.4	4.4 5.4	V
		V _{IN} = V _{IL} or V _{IH} I _{OH} -24mA -24 mA	4.5 5.5		3.86 4.86	3.76 4.76	V
V _{OL}	Maximum Low Level Output Voltage	I _{OUT} = 50 μA	4.5 5.5	0.001 0.001	0.1 0.1	0.1 0.1	V
		V _{IN} = V _{IL} or V _{IH} I _{OL} 24mA 24 mA	4.5 5.5		0.36 0.36	0.44 0.44	V
I _{IN}	Maximum Input Leakage Current	V _I = V _{CC} , GND	5.5		±0.1	±1.0	μA
ΔI _{CC} T	Additional Max I _{CC} /Input	V _I = V _{CC} - 2.1 V	5.5	0.6		1.5	mA
I _{CC}	Maximum Quiescent Supply Current	V _{IN} = V _{CC} or GND	5.5		8.0	80	μA

AC CHARACTERISTICS

Symbol	Parameter (C _L = 50 pF)	V _{CC} ±10%(V)	ACT161				ACT163				Unit
			T _A = +25°C		T _A = -40°C to +85°C		T _A = +25°C		T _A = -40°C to +85°C		
			Min	Max	Min	Max	Min	Max	Min	Max	
f _{max}	Maximum Count Frequency	5.0	115		100		120		105		MHz
t _{PLH}	Propagation Delay Clock to Q _n	5.0	1.5	9.5	1.5	10.5	1.5	10.0	1.5	11.0	ns
t _{PHL}	Propagation Delay Clock to Q _n (Load Input HIGH or LOW)	5.0	1.5	10.5	1.5	11.5	1.5	11.0	1.5	12.0	
t _{PLH}	Propagation Delay Clock to Ripple Carry Out	5.0	2.0	11.0	1.5	12.5	2.5	11.5	2.0	13.5	ns
t _{PHL}	Propagation Delay Clock to Ripple Carry Out	5.0	1.5	12.5	1.5	13.5	3.0	13.5	2.0	15.0	ns
t _{PLH}	Propagation Delay Enable T to Ripple Carry Out	5.0	1.5	8.5	1.5	10.0	2.0	9.0	1.5	10.5	ns
t _{PHL}	Propagation Delay Enable T to Ripple Carry Out	5.0	1.5	9.5	1.5	10.5	2.0	10.0	2.0	11.0	ns
t _{PHL}	Propagation Delay Master Reset to Q _n	5.0	1.5	10.0	1.5	11.0	74ACT161 Only				ns

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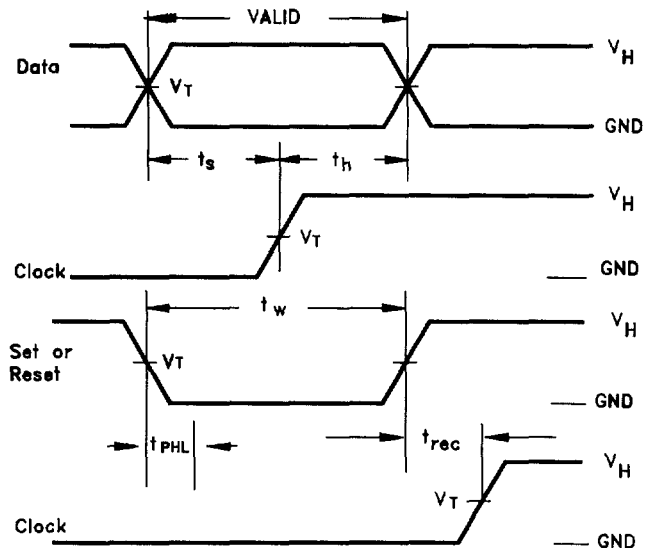
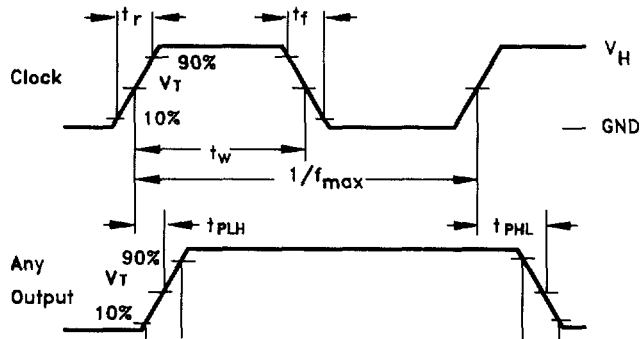
Symbol	Parameter ($C_L = 50 \text{ pF}$)	V_{CC} $\pm 10\%(V)$	ACT161				ACT163				Unit
			$T_A = +25^\circ\text{C}$		$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$		$T_A = +25^\circ\text{C}$		$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$		
			Min	Max	Min	Max	Min	Max	Min	Max	
t_{PHL}	Propagation Delay Master Reset to Ripple Carry Out	5.0	2.5	13.5	2.0	14.5	74ACT161 Only				ns

AC OPERATING REQUIREMENTS

Symbol	Parameter	V_{CC} $\pm 10\% V$	ACT161		ACT163		Unit
			$T_A = +25^\circ\text{C}$	$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	$T_A = +25^\circ\text{C}$	$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	
			Guaranteed Minimum		Guaranteed Minimum		
t_s	Setup Time, HIGH or LOW P_n to Clock	5.0	9.5	11.5	10	12	ns
t_h	Hold Time, HIGH or LOW P_n to Clock	5.0	0	0	0.5	0.5	ns
t_s	Setup Time, HIGH or LOW Load to Clock	5.0	8.5	9.5	8.5	10.5	ns
t_h	Hold Time, HIGH or LOW Load to Clock	5.0	-0.5	-0.5	-0.5	0	ns
t_w	Clock Pulse Width (Load) HIGH or LOW	5.0	3.0	3.5	3.5	3.5	ns
t_w	Clock Pulse Width (Count) HIGH or LOW	5.0	3.0	3.5	3.5	3.5	ns
t_w	Master Reset Pulse Width, LOW	5.0	3.0	7.5			ns
t_{rec}	Recovery Time, Master Reset to Clock	5.0	0	0.5			ns

SWITCHING WAVEFORMS

Input and output threshold voltage:
 $V_T = 50\% V_{CC}$ for AC; 1.5V for ACT
 $V_H = V_{CC}$ for AC, 3V for ACT



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