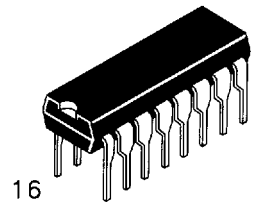
Available Q2, 1995

Dual $\overline{JK}$ Positive Edge-Triggered Flip-Flop

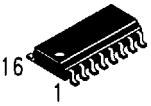
DV74AC109
DV74ACT109

This device consists of two high speed JK flip flops. Both normal and inverted outputs are available. The device can be asynchronously set or reset, or synchronously clocked.

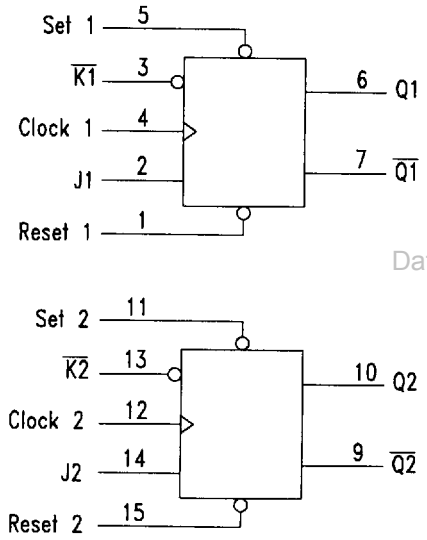
- **Advanced very high speed CMOS**
- **Outputs source/sink 24 mA**
- **Transmission line driving 50 ohms**
- **ACT has TTL compatible inputs**
- **AC Device Operation from 2 to 6 volts guaranteed**
- **DC & AC Parameters guaranteed over –40 to +85°C**



N Suffix
Plastic DIP
AVG-003 Case

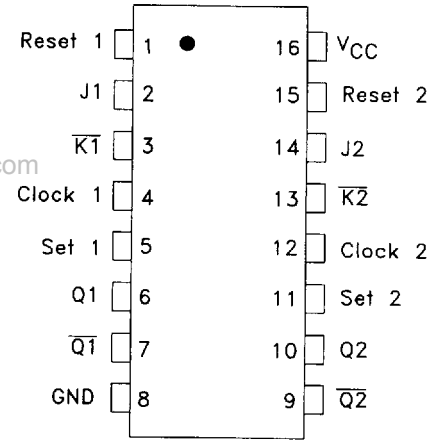


D Suffix
Plastic SOP
AVG-004 Case



PIN 16 = V_{CC}
PIN 8 = GND

PIN ASSIGNMENT



TRUTH TABLE

Inputs					Output	
Set	Reset	Clock	J	$\overline{K}$	Q	$\overline{Q}$
L	H	X	X	X	H	L
H	L	X	X	X	L	H
L	L	X	X	X	H*	H*
H	H	↑	L	L	L	H
H	H	↑	H	L	Toggle	Toggle
H	H	↑	L	H	Qo	$\overline{Qo}$
H	H	↑	H	H	H	L
H	H	L	X	X	Qo	$\overline{Qo}$

H=High Logic Level L=Low Logic Level
X=Don't Care Qo=Previous State of Q
↑ = Low to High Transition
* Both outputs will remain high as long as Set and Reset are low, but the output states are unpredictable if Set and Reset go high simultaneously

ABSOLUTE MAXIMUM RATINGS

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

Symbol	Parameter	AC109, ACT109	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
Tstg	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	25	85	°C
C_{IN}	Input Capacitance	V_{CC} = 5.0 V		4.5		pF
C_{PD}	Power Dissipation Capacitance	V_{CC} = 5.0 V		35		pF

1. V_{IN} from 30% to 70% V_{CC}
2. V_{IN} from 0.8 to 2.0 V

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V_{CC} (V)	AC109			Unit
				TA = +25°C		TA = –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 4.5 5.5	1.5 2.25 2.75	2.1 3.15 3.85	2.1 3.15 3.85	V
V_{IL}	Maximum Low Level Input Voltage	V_{OUT} = 0.1V or V_{CC} – 0.1 V	3.0 4.5 5.5	1.5 2.25 2.75	0.9 1.35 1.65	0.9 1.35 1.65	V
V_{OH}	Minimum High Level Output Voltage	I_{OUT}= –50 µA	3.0 4.5 5.5	2.99 4.49 5.49	2.9 4.4 5.4	2.9 4.4 5.4	V
		V_{IN} = V_{IL} or V_{IH} I_{OH} –12mA –24mA –24mA	3.0 4.5 5.5		2.56 3.86 4.86	2.46 3.76 4.76	V

DC ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Conditions	V_{CC} (V)	AC109			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 4.5 5.5	0.002 0.001 0.001	0.1 0.1 0.1	0.1 0.1 0.1	V
		V_{IN} = V_{IL} or V_{IH} 12mA I_{OL} 24mA 24mA	3.0 4.5 5.5		0.36 0.36 0.36	0.44 0.44 0.44	V
I_{IN}	Maximum Input Leakage Current	V_{IN} = V_{CC} or GND	5.5		±0.1	±1.0	µA
I_{CC}	Maximum Quiescent Supply Current	V_{IN} = V_{CC} or GND	5.5		4.0	40	µA

AC CHARACTERISTICS over full operating conditions

Symbol	Parameter	V_{CC} ±10% (V)	AC109				Unit
			T_A = +25°C C_L = 50 pF		T_A = – 40°C to +85°C C_L = 50 pF		
			Min	Max	Min	Max	
f_{MAX}	Maximum Clock Frequency	3.3	125 150		100 125		MHz
t_{PLH}	Propagation Delay Clock to Output	3.3 5.0	4.0 2.5	13.5 10.0	3.5 2.0	16.0 10.5	ns
t_{PHL}	Propagation Delay Clock to Output	3.3 5.0	3.0 2.0	14.0 10.0	3.0 1.5	14.5 10.5	ns
t_{PLH}	Propagation Delay Reset or Set to Output	3.3 5.0	3.0 2.0	12.0 9.0	2.5 2.0	13.0 10.0	ns
t_{PHL}	Propagation Delay Reset or Set to Output	3.3 5.0	3.0 2.0	12.0 9.5	3.0 2.0	13.5 10.5	ns
t_S	Setup Time, HIGH or LOW Data Input to Clock	3.3 5.0	6.5 4.5		7.5 5.0		ns
t_h	Hold Time, HIGH or LOW Data Input to Clock	3.3 5.0	0 0.5		0 0.5		ns
t_w	Pulse Width Clock, Set or Reset	3.3 5.0	4.0 3.5		4.5 3.5		ns
t_{rec}	Recovery Time Set or Reset to Clock	3.3 5.0	0 0		0 0		ns

ACT — 109

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V_{CC} (V)	ACT109			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

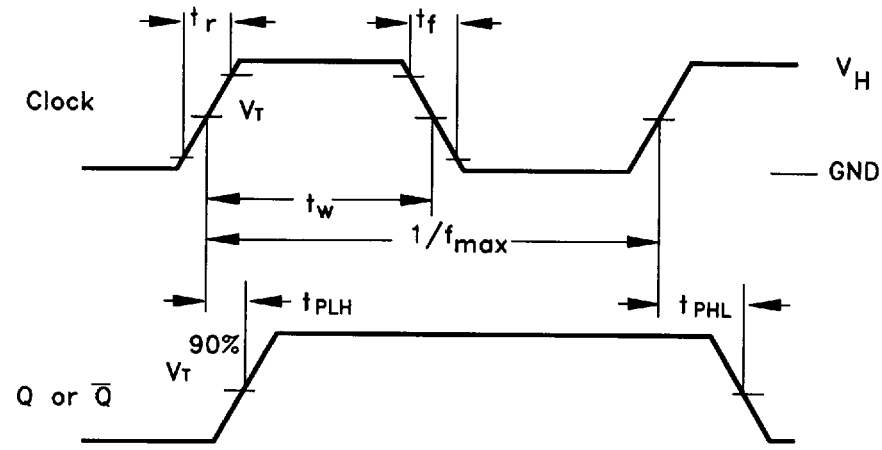
DC ELECTRICAL CHARACTERISTICS(continued)

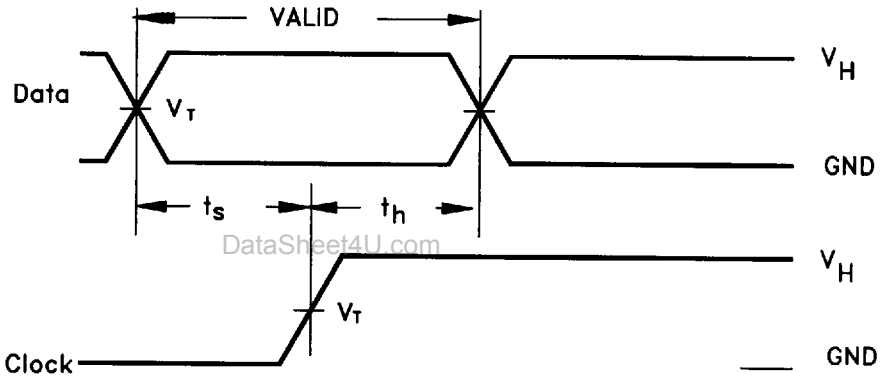
Symbol	Parameter	Conditions	V_{CC} (V)	ACT109			Unit
				TA = +25°C		TA = –40 to +85°C	
				Typ	Guaranteed Limits		
V_{OH}	Minimum High Level Output Voltage	I_{OUT} = –50 µA	4.5 5.5	4.49 5.49	4.4 5.4	4.4 5.4	V
		V_{IN} = V_{IL} or V_{IH} I_{OH} –24mA –24 mA	4.5 5.5		3.86 4.86	3.76 4.76	V
V_{OL}	Maximum 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_{IN} = VCC or GND	5.5		±0.1	±1.0	µA
ΔI_{CCT}	Additional Max I_{CC}/Input	V_{IN} = 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		4.0	40	µA

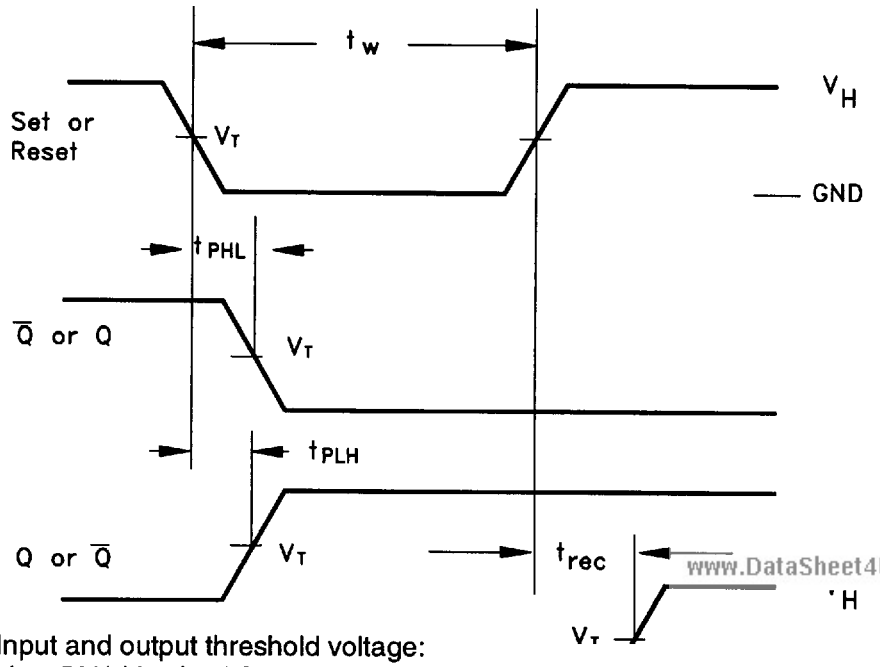
AC CHARACTERISTICS over full operating conditions

Symbol	Parameter	V_{CC} ±10% (V)	ACT109				Unit
			T_A = +25°C C_L = 50 pF		T_A = – 40°C to +85°C C_L = 50 pF		
			Min	Max	Min	Max	
f_{MAX}	Maximum Clock Frequency	5.0	145		125		MHz
t_{PLH}	Propagation Delay, Clock to Output	5.0	4.0	11.0	3.5	13.0	ns
t_{PHL}	Propagation Delay, Clock to Output	5.0	3.0	10.0	2.5	11.5	ns
t_{PLH}	Propagation Delay, Reset or Set to Output	5.0	2.5	9.5	2.0	10.5	ns
t_{PHL}	Propagation Delay Reset or Set to Output	5.0	2.5	10.0	2.0	11.5	ns
t_S	Setup Time, HIGH or LOW Data Input to Clock	5.0	2.0		2.5		ns
t_h	Hold Time, HIGH or LOW Data Input to Clock	5.0	2.0		2.0		ns
t_w	Pulse Width Clock, Set or Reset	5.0	5.0		6.0		ns
t_{rec}	Recovery Time Set or Reset to Clock	5.0	0		0		ns

SWITCHING WAVEFORMS







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