

UT54ACS109/UT54ACTS109

Radiation-Hardened Dual J-K Flip-Flops

Dec. 1, 2003

FEATURES

- 1.2 μ radiation-hardened CMOS (ACTS109) and 0.6 μ CRH CMOS process (ACS109)
 - Latchup immune
- High speed
- Low power consumption
- Single 5 volt supply
- Available QML Q or V processes
- Flexible package
 - 16-pin DIP (not available for ACS109)
 - 16-lead flatpack

DESCRIPTION

The UT54ACS109 and the UT54ACTS109 are dual J- \bar{K} positive triggered flip-flops. A low level at the preset or clear inputs sets or resets the outputs regardless of the other input levels. When preset and clear are inactive (high), data at the J and \bar{K} input meeting the setup time requirements are transferred to the outputs on the positive-going edge of the clock pulse. Following the hold time interval, data at the J and \bar{K} input can be changed without affecting the levels at the outputs. The flip-flops can perform as toggle flip-flops by grounding \bar{K} and tying J high. They also can perform as D flip-flops if J and \bar{K} are tied together.

The devices are characterized over full military temperature range of -55°C to +125°C.

FUNCTION TABLE

INPUTS					OUTPUT	
\overline{PRE}	\overline{CLR}	CLK	J	\bar{K}	Q	\bar{Q}
L	H	X	X	X	H	L
H	L	X	X	X	L	H
L	L	X	X	X	H ¹	H ¹
H	H	↑	L	L	L	H
H	H	↑	H	L	Toggle	
H	H	↑	L	H	No Change	
H	H	↑	H	H	H	L
H	H	L	X	X	No Change	

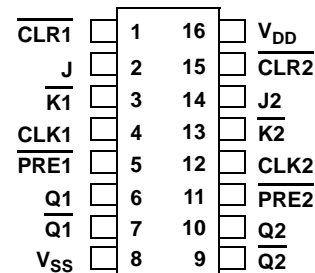
Note:

1. The output levels in this configuration are not guaranteed to meet the minimum levels for V_{OH} if the lows at preset and clear are near V_{IL} maximum. In

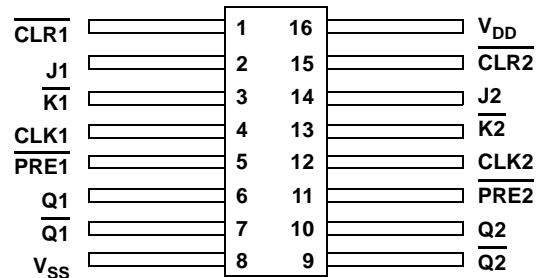
addition, this configuration is nonstable; that is, it will not persist when either preset or clear returns to its inactive (high) level.

PINOUTS

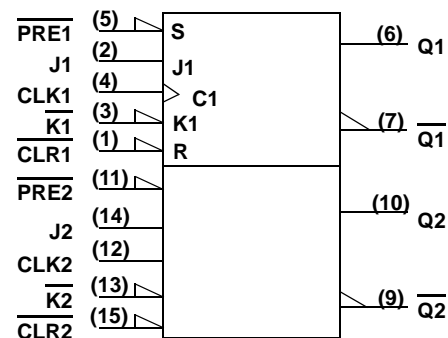
16-Pin DIP Top View



16-Lead Flatpack Top View



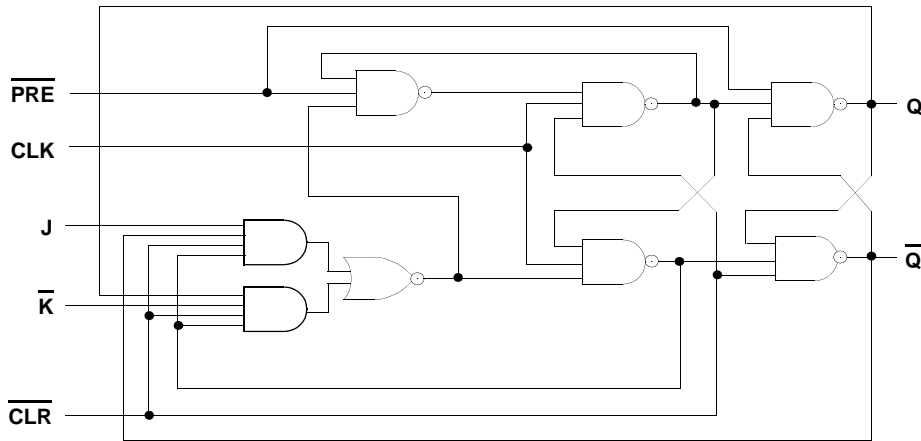
LOGIC SYMBOL



Note:

1. Logic symbol in accordance with ANSI/IEEE standard 91-1984 and IEC Publication 617-12.

LOGIC DIAGRAM



RADIATION HARDNESS SPECIFICATIONS ¹

PARAMETER	LIMIT	UNITS
Total Dose	1.0E6 (ACTS109) 5.0E5 (ACS109)	rads(Si)
SEU Threshold ²	80	MeV-cm ² /mg
SEL Threshold	120	MeV-cm ² /mg
Neutron Fluence	1.0E14	n/cm ²

Notes:

1. Logic will not latchup during radiation exposure within the limits defined in the table.
2. Device storage elements are immune to SEU affects.

ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	LIMIT	UNITS
V _{DD}	Supply voltage	-0.3 to 7.0	V
V _{I/O}	Voltage any pin	-.3 to V _{DD} +.3	V
T _{STG}	Storage Temperature range	-65 to +150	°C
T _J	Maximum junction temperature	+175	°C
T _{LS}	Lead temperature (soldering 5 seconds)	+300	°C
Θ _{JC}	Thermal resistance junction to case	20	°C/W
I _I	DC input current	±10	mA
P _D	Maximum power dissipation	1	W

Note:

1. Stresses outside the listed absolute maximum ratings may cause permanent damage to the device. This is a stress rating only, functional operation of the device at these or any other conditions beyond limits indicated in the operational sections is not recommended. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMIT	UNITS
V_{DD}	Supply voltage	4.5 to 5.5	V
V_{IN}	Input voltage any pin	0 to V_{DD}	V
T_C	Temperature range	-55 to + 125	°C

DC ELECTRICAL CHARACTERISTICS ⁷(V_{DD} = 5.0V ±10%; V_{SS} = 0V ⁶, -55°C < T_C < +125°C)

SYMBOL	PARAMETER	CONDITION	MIN	MAX	UNIT
V _{IL}	Low-level input voltage ¹ ACTS ACS			0.8 .3V _{DD}	V
V _{IH}	High-level input voltage ¹ ACTS ACS		.5V _{DD} .7V _{DD}		V
I _{IN}	Input leakage current ACTS/ACS	V _{IN} = V _{DD} or V _{SS}	-1	1	μA
V _{OL}	Low-level output voltage ³ ACTS ACS	I _{OL} = 8.0mA I _{OL} = 100μA		0.40 0.25	V
V _{OH}	High-level output voltage ³ ACTS ACS	I _{OH} = -8.0mA I _{OH} = -100μA	.7V _{DD} V _{DD} - 0.25		V
I _{OS}	Short-circuit output current ^{2,4} ACTS/ACS	V _O = V _{DD} and V _{SS}	-200	200	mA
I _{OL}	Output current ¹⁰ (Sink)	V _{IN} = V _{DD} or V _{SS} V _{OL} = 0.4V	8		mA
I _{OH}	Output current ¹⁰ (Source)	V _{IN} = V _{DD} or V _{SS} V _{OH} = V _{DD} - 0.4V	-8		mA
P _{total}	Power dissipation ^{2, 8,9}	C _L = 50pF		2.0	mW/ MHz
I _{DDQ}	Quiescent Supply Current	V _{DD} = 5.5V		10	μA
ΔI _{DDQ}	Quiescent Supply Current Delta ACTS	For input under test V _{IN} = V _{DD} - 2.1V For all other inputs V _{IN} = V _{DD} or V _{SS} V _{DD} = 5.5V		1.6	mA
C _{IN}	Input capacitance ⁵	f = 1MHz @ 0V		15	pF
C _{OUT}	Output capacitance ⁵	f = 1MHz @ 0V		15	pF

UT54ACS109/UT54ACTS109

Notes:

1. Functional tests are conducted in accordance with MIL-STD-883 with the following input test conditions: $V_{IH} = V_{IH(min)} + 20\%$, $- 0\%$; $V_{IL} = V_{IL(max)} + 0\%$, $- 50\%$, as specified herein, for TTL, CMOS, or Schmitt compatible inputs. Devices may be tested using any input voltage within the above specified range, but are guaranteed to $V_{IH(min)}$ and $V_{IL(max)}$.
2. Supplied as a design limit but not guaranteed or tested.
3. Per MIL-PRF-38535, for current density $\leq 5.0E5$ amps/cm², the maximum product of load capacitance (per output buffer) times frequency should not exceed 3,765 pF/MHz.
4. Not more than one output may be shorted at a time for maximum duration of one second.
5. Capacitance measured for initial qualification and when design changes may affect the value. Capacitance is measured between the designated terminal and V_{SS} at frequency of 1MHz and a signal amplitude of 50mV rms maximum.
6. Maximum allowable relative shift equals 50mV.
7. All ACTS specifications are valid for radiation dose $\leq 1E6$ rads(Si), and all ACS specifications are valid for radiation dose $\leq 5E5$ rads(Si).
8. Power does not include power contribution of any TTL output sink current.
9. Power dissipation specified per switching output.
10. This value is guaranteed based on characterization data, but not tested.

AC ELECTRICAL CHARACTERISTICS ²(V_{DD} = 5.0V ±10%; V_{SS} = 0V ¹, -55°C < T_C < +125°C)

SYMBOL	PARAMETER	MINIMUM	MAXIMUM	UNIT
t _{PHL}	CLK to Q, \overline{Q}	5	27	ns
t _{PLH}	CLK to Q, \overline{Q}	4	23	ns
t _{PLH}	\overline{PRE} to Q	1	16	ns
t _{PHL}	\overline{PRE} to \overline{Q}	1	19	ns
t _{PHL}	\overline{CLR} to Q	2	19	ns
t _{PLH}	\overline{CLR} to \overline{Q}	2	16	ns
f _{MAX}	Maximum clock frequency		62	MHz
t _{SU1}	\overline{PRE} or \overline{CLR} inactive Setup time before CLK ↑	5		ns
t _{SU2}	Data setup time before CLK ↑	5		ns
t _H ³	Data hold time after CLK ↑	3		ns
t _W	Minimum pulse width \overline{PRE} or \overline{CLR} low CLK high CLK low	8		ns

Notes:

1. Maximum allowable relative shift equals 50mV.
2. For the ACTS version, all specifications are valid for radiation dose ≤1E6 rads(Si). For the ACS version, all specifications are valid for radiation dose ≤5E5 rads(Si).
3. Based on characterization, hold time (t_H) of 0ns can be assumed if data setup time (t_{SU2}) is ≥10ns. This is guaranteed, but not tested.