SIGNETICS DCL INTEGRATED CIRCUITS

8H20 DUAL J-K BINARY ELEMENT
8H21 DUAL J-K BINARY ELEMENT
8H22 DUAL J-K BINARY ELEMENT

The 8H20 is a high speed J-K Binary which uses stored charge techniques to effect the toggling action. This type of clocking technique provides all the advantages of level sensitive binaries and retains all the speed/power advantages of rate sensitive binaries. This binary is designed to toggle at frequencies from near DC to greater than 50MHz.

The change of state is caused by the negative logic transition of the clock input and is effectively carried out with a clock pulse width of 7ns minimum and up to a maximum 200ns fall time.

There is no hold time requirement for the inputs. This means that logic transistions to a logic "1" or "0" can occur coincidentally with the logic "1" transition of the clock input.

The logic states of the J and K inputs must be stable when the clock input reaches 2.0V. These must remain stable until the clock falls if maximum utilization of the binary speed is desired.

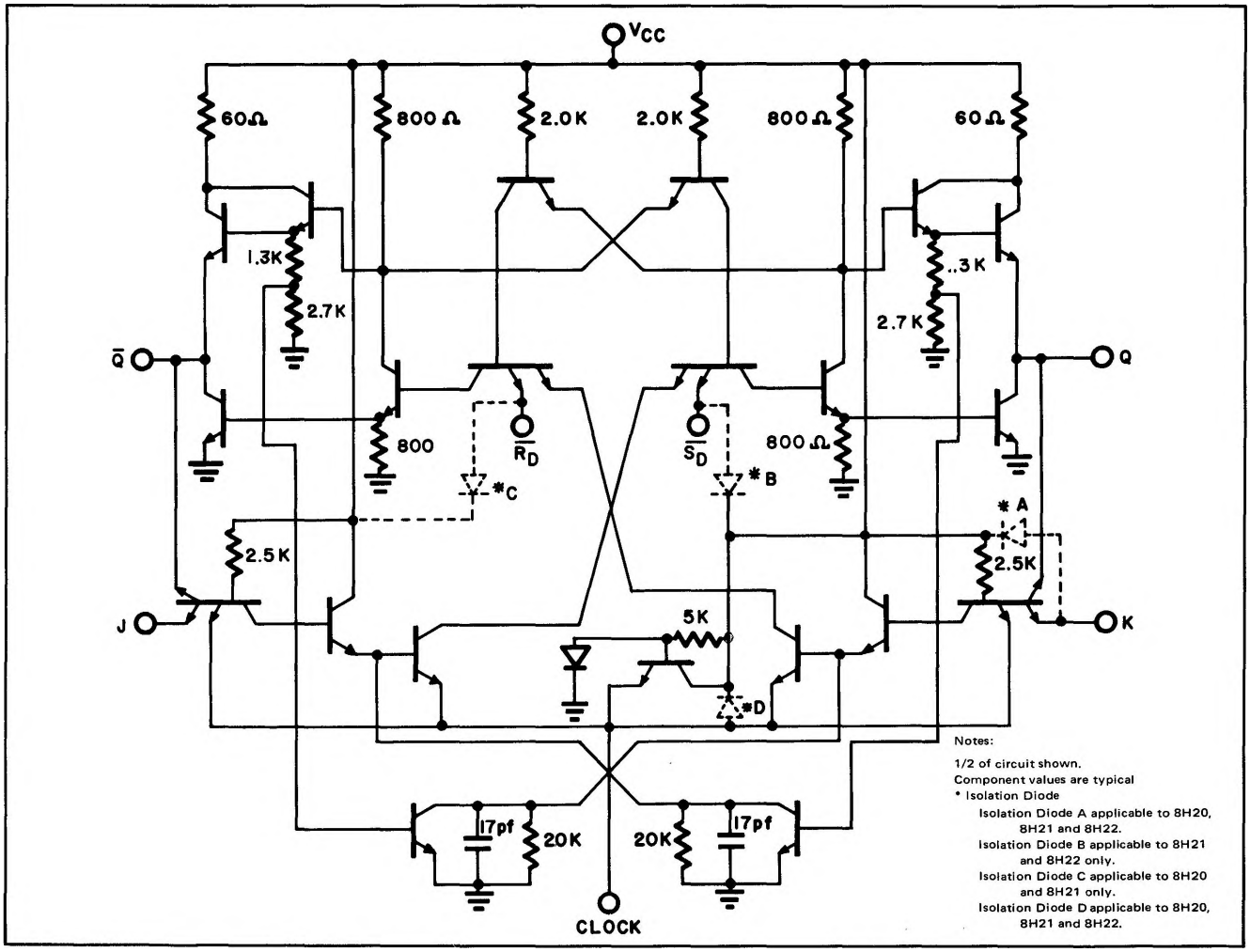
Clocking transitions should be avoided when the asynchronous lines are activated and the J and K inputs are at logic "1" levels. If this condition exists, a positive transient will be generated on the output which is normally at the logic "0" state. The duration of this transient may be about 20ns.

The 8H21 features common clock and common $\overline{R}_D$ lines.

The 8H22 provides separate inputs for clock, J, K, $\overline{R}_D$ and $\overline{S}_D$ on each binary and is available only in the 16-pin dual-in-line package.

Applications information and usage rules for these devices are included in Section 4 of this handbook.

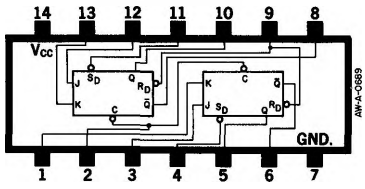
BASIC CIRCUIT SCHEMATIC



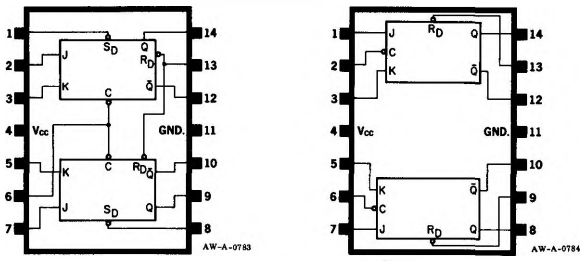
A, F PACKAGE

8H21A

(8H22B package on next page)



8H21Q Q PACKAGES 8H20Q



8H20
8H21
8H22

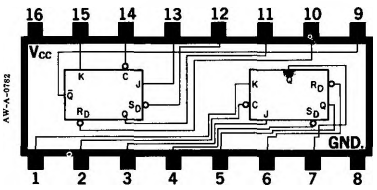
ELECTRICAL CHARACTERISTICS (NOTES: 1, 2, 3, 4, 5, 6, 14)

ACCEPTANCE TEST SUB-GROUP	CHARACTERISTIC	LIMITS				TEST CONDITIONS									
		MIN.	TYP.	MAX.	UNITS	TEMP. S8H21 S8H22 S8H20	TEMP. N8H21 N8H22 N8H20	V_{CC}	$\overline{R}_D$	$\overline{S}_D$	J	K	CLOCK	OUTPUT	NOTES
A-5	"1" OUTPUT VOLTAGE (Q)	2.6	3.0		V	-55°C	0°C	4.75V	2.0V	0.8V	2.0V	0.8V	PULSE	1.0mA	7, 10, 17
A-3		2.8	3.2		V	+25°C	+25°C	5.0V	2.0V	0.8V	2.0V	0.8V	PULSE	1.0mA	7, 10, 17
A-4		2.6	3.0		V	+125°C	+75°C	4.75V	2.0V	0.8V	2.0V	0.8V	PULSE	1.0mA	7, 10, 17
A-5	"1" OUTPUT VOLTAGE ($\overline{Q}$)	2.6	3.0		V	-55°C	0°C	4.75V	0.8V	2.0V				1.0mA	7
A-3		2.8	3.2		V	+25°C	+25°C	5.0V	0.8V	2.0V				1.0mA	7
A-4		2.6	3.0		V	+125°C	+75°C	4.75V	0.8V	2.0V				1.0mA	7
A-5	"0" OUTPUT VOLTAGE (Q)		0.3	0.4	V	-55°C	0°C	4.75V	0.8V	2.0V				24mA	8
A-3			0.3	0.4	V	+25°C	+25°C	5.0V	0.8V	2.0V				24mA	8
A-4			0.3	0.4	V	+125°C	+75°C	4.75V	0.8V	2.0V				24mA	8
A-5	"0" OUTPUT VOLTAGE ($\overline{Q}$)		0.3	0.4	V	-55°C	0°C	4.75V	2.0V	0.8V	2.0V	0.8V	PULSE	24mA	8, 10, 17
A-3			0.3	0.4	V	+25°C	+25°C	5.0V	2.0V	0.8V	2.0V	0.8V	PULSE	24mA	8, 10, 17
A-4			0.3	0.4	V	+125°C	+75°C	4.75V	2.0V	0.8V	2.0V	0.8V	PULSE	24mA	8, 10, 17
	"0" INPUT CURRENT														
C-1	(CLOCK, 8H21 only)	-0.1		-4.8	mA	-55°C	0°C	5.25V			5.25V	5.25V	0.4V		
A-3		-0.1		-4.8	mA	+25°C	+25°C	5.25V			5.25V	5.25V	0.4V		
C-1		-0.1		-4.8	mA	+125°C	+75°C	5.25V			5.25V	5.25V	0.4V		
C-1	(CLOCK, 8H20 and 8H22 only)	-0.1		-2.4	mA	-55°C	0°C	5.25V			5.25V	5.25V	0.4V		
A-3		-0.1		-2.4	mA	+25°C	+25°C	5.25V			5.25V	5.25V	0.4V		
C-1		-0.1		-2.4	mA	+125°C	+75°C	5.25V			5.25V	5.25V	0.4V		
C-1	(J)	-0.1		-2.4	mA	-55°C	0°C	5.25V	0V	5.25V	0.4V	5.25V	5.25V	$\overline{Q}/\overline{Q}$ = "1"	
A-3		-0.1		-2.4	mA	+25°C	+25°C	5.25V	0V	5.25V	0.4V	5.25V	5.25V	$\overline{Q}/\overline{Q}$ = "1"	
C-1		-0.1		-2.4	mA	+125°C	+75°C	5.25V	0V	5.25V	0.4V	5.25V	5.25V	$\overline{Q}/\overline{Q}$ = "1"	
C-1	(K)	-0.1		-2.4	mA	-55°C	0°C	5.25V	5.25V	0V	5.25V	0.4V	5.25V	Q = "1"	10
A-3		-0.1		-2.4	mA	+25°C	+25°C	5.25V	5.25V	0V	5.25V	0.4V	5.25V	Q = "1"	10
C-1		-0.1		-2.4	mA	+125°C	+75°C	5.25V	5.25V	0V	5.25V	0.4V	5.25V	Q = "1"	10
C-1	($\overline{R}_D$ 8H21 only)	-0.1		-4.8	mA	-55°C	0°C	5.25V	0.4V	0V			5.25V		
A-3		-0.1		-4.8	mA	+25°C	+25°C	5.25V	0.4V	0V			5.25V		
C-1		-0.1		-4.8	mA	+125°C	+75°C	5.25V	0.4V	0V			5.25V		
C-1	($\overline{R}_D$ 8H22 only)	-0.1		-2.4	mA	-55°C	0°C	5.25V	0.4V	0V			5.25V		
A-3		-0.1		-2.4	mA	+25°C	+25°C	5.25V	0.4V	0V			5.25V		
C-1		-0.1		-2.4	mA	+125°C	+75°C	5.25V	0.4V	0V			5.25V		
C-1	($\overline{R}_D$ 8H20 only)			-2.4	mA	-55°C	0°C	5.25V	0.4V				5.25V		
A-3				-2.4	mA	+25°C	+25°C	5.25V	0.4V				5.25V		
C-1				-2.4	mA	+125°C	+75°C	5.25V	0.4V				5.25V		
C-1	($\overline{S}_D$ 8H21 and 8H22 only)	-0.1		-2.4	mA	-55°C	0°C	5.25V	0V	0.4V			5.25V		
A-3		-0.1		-2.4	mA	+25°C	+25°C	5.25V	0V	0.4V			5.25V		
C-1		-0.1		-2.4	mA	+125°C	+75°C	5.25V	0V	0.4V			5.25V		
	"1" INPUT CURRENT														
A-4	(J)			50	μA	+125°C	+75°C	5.0V			4.5V		0.4V		
A-4	(K)			50	μA	+125°C	+75°C	5.0V				4.5V	0.4V		
A-4	($\overline{R}_D$ 8H21 only)			100	μA	+125°C	+75°C	5.0V	4.5V	0V			0.4V	$\overline{Q}$ = "0"	
A-4	($\overline{R}_D$ 8H20 and 8H22 only)			50	μA	+125°C	+75°C	5.0V	4.5V	0V				$\overline{Q}$ = "0"	10
A-4	($\overline{S}_D$ 8H21 and 8H22 only)			50	μA	+125°C	+75°C	5.0V	0V	4.5V				Q = "0"	
A-4	(CLOCK 8H21 only)			400	μA	+125°C	+75°C	5.0V			0V	0V	4.5V		
A-4	(CLOCK 8H20 and 8H22 only)			200	μA	+125°C	+75°C	5.0V			0V	0V	4.5V		
	INPUT LATCH VOLTAGE RATING														
C-1	(CLOCK 8H21 only)	6.0			V	+25°C	+25°C	5.5V			0V	0V	10mA		12
C-1	(CLOCK 8H20 and 8H22 only)	6.0			V	+25°C	+25°C	5.5V		0V	0V	0V	10mA		12
C-1	(J)	6.0			V	+25°C	+25°C	5.5V		0V	10mA		0.4V		12
C-1	(K)	6.0			V	+25°C	+25°C	5.5V	0V			10mA	0.4V		12
C-1	($\overline{R}_D$ 8H21 only)	6.0			V	+25°C	+25°C	5.5V	10mA				0.4V	$\overline{Q}$ = "0"	10
C-1	($\overline{R}_D$ 8H20 and 8H22 only)	6.0			V	+25°C	+25°C	5.5V	10mA				0.4V	$\overline{Q}$ = "0"	10
C-1	($\overline{S}_D$ 8H21 and 8H22 only)	6.0			V	+25°C	+25°C	5.5V	0V	10mA			0.4V	Q = "0"	
	OUTPUT SHORT CIRCUIT CURRENT														
A-2	(Q)	-40		-90	mA	+25°C	+25°C	5.0V		0V				0V	11
A-2	($\overline{Q}$)	-40		-90	mA	+25°C	+25°C	5.0V	0V					0V	11
A-2	POWER CONSUMPTION (Per Binary)		65	90	mW	+25°C	+25°C	5.25V			0V	0V			
	TURN-ON DELAY														
	(CLOCK to Q, $\overline{Q}$)		10		ns	+25°C	+25°C	5.0V						D.C.F.O. = 30	9, 13
	($\overline{R}_D$ to Q)		10		ns	+25°C	+25°C	5.0V						D.C.F.O. = 30	9, 13
	($\overline{S}_D$ to $\overline{Q}$)		10		ns	+25°C	+25°C	5.0V						D.C.F.O. = 30	9, 13
	TURN-OFF DELAY														
	(CLOCK to Q, $\overline{Q}$)		8		ns	+25°C	+25°C	5.0V						D.C.F.O. = 30	9, 13
	($\overline{R}_D$ to $\overline{Q}$)		8		ns	+25°C	+25°C	5.0V						D.C.F.O. = 30	9, 13
	($\overline{S}_D$ to Q)		8		ns	+25°C	+25°C	5.0V						D.C.F.O. = 30	9, 13
A-6	TOGGLE RATE	50	75		MHz	+25°C	+25°C	5.0V						D.C.F.O. = 3	9, 13
C-2	MINIMUM CLOCK PULSE WIDTH		3.0	7	ns	+25°C	+25°C	5.0V						D.C.F.O = 3	9, 13
C-2	OUTPUT FALL TIME			50	ns	-55°C	0°C	4.75V						A.C.F.O. = 6	13, 15
	INPUT CAPACITANCE														
C-2	J, K			3.0	pf	+25°C	+25°C	5.0V			2.0V	2.0V			16
C-2	$\overline{S}_D$ (8H21, 8H22)			3.0	pf	+25°C	+25°C	5.0V		2.0V					16
C-2	$\overline{R}_D$ (8H20, 8H22)			3.0	pf	+25°C	+25°C	5.0V	2.0V						16
C-2	C (8H20, 8H22)			3.0	pf	+25°C	+25°C	5.0V					2.0V		16
C-2	C, $\overline{R}_D$ (8H21)			6.0	pf	+25°C	+25°C	5.0V	2.0V				2.0V		16
	CLOCK MODE SWITCHING TEST		200		ns	+25°C	+25°C	5.0V					PULSE		

8H20
8H21
8H22

B PACKAGE

8H22B



8H20			8H21 and 8H22					
J_n	K_n	Q_{n+1}	J_n	K_n	Q_{n+1}	$\overline{S}_D$	$\overline{R}_D$	Q
0	0	Q_n	0	0	Q_n	0	0	†
1	0	1	1	0	1	1	0	0
0	1	0	0	1	0	0	1	1
1	1	$\overline{Q}_n$	1	1	$\overline{Q}_n$	1	1	Q

$\overline{R}_D = 0 \Rightarrow Q = 0$

† Not Allowed

Notes:

1. All voltage and capacitance measurements are referenced to the ground terminal. Terminals not specifically referenced are left electrically open.
2. All measurements are taken with ground pin tied to zero volts.
3. Positive current flow is defined as into the terminal referenced.
4. Positive NAND Logic definition: "UP" Level = "1", "DOWN" Level = "0".
5. Precautionary measures should be taken to ensure current limiting in accordance with Absolute Maximum Ratings should the isolation diodes become forward biased.
6. Measurements apply to each element independently.
7. Output source current is supplied through a resistor to ground.
8. Output sink current is supplied through a resistor to V_{cc}.
9. One DC fan-out is defined as the input of an 8480 or 0.8mA.
10. When testing the 8H20, apply a clock pulse prior to measurement to ensure Q = "1" and $\overline{Q}$ = "0". Clock pulse characteristics are: PW = 100ns; Pulse Amplitude = 3.0V; t_r = 10ns; t_f = 10ns.
11. For output short circuit current, test one output at a time. For 8H20, test $\overline{Q}$ only.
12. This test guarantees operation free of input latch-up over the specified operating power supply voltage range.
13. Detailed test conditions tor AC testing are in Section 3.
14. Manufacturer reserves the right to make design and process changes and improvements.
15. One AC fan-out is defined as 50pf.
16. Capacitance as measured on Boonton Electronic Corporation Model 75A-S8 Capacitance Bridge or equivalent. f = 1MHz, V_{ac} = 25mV_{rms}. All pins not specifically referenced are tied to guard for capacitance tests. Output pins are left open.
17. Conditions shown under J, K, and Clock apply to S/N8H20 only.