

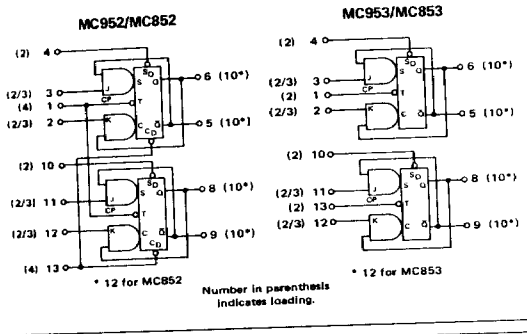
DUAL J-K FLIP-FLOP

**MC952F · MC852F, P**  
**MC953F · MC853F, P**  
**MC955F · MC855F, P**  
**MC956F · MC856F, P**

Each section of the monolithic MC952/MC852 and MC953/MC853 dual J-K clocked flip-flops consists of two directly-coupled flip-flops operating on the "master-slave" principle. Operation depends only on voltage levels, so the rise and fall times of the input clock are unimportant in determining the state of the flip-flop. Input information is stored in the "master" flip-flop when the clock voltage is high and is transferred to the "slave" when the clock voltage goes low.

The MC952/MC852 has a common clock input which makes this device suitable for clocked counters and shift register applications. A common direct clear (C<sub>D</sub>) and separate direct sets (S<sub>D</sub>) are available. The direct inputs override all asynchronous inputs.

The MC953/MC853 has separate clock inputs to each flip-flop, which makes the device suitable for ripple counter applications. Separate direct set inputs which override the synchronous inputs are also provided. The outputs of the flip-flops are buffered, thereby reducing the possibility of circuit disturbance from external line noise.



Total Power Dissipation  
 MC952/MC852, MC953/MC853  
 - 120 mW typ/pkg  
 MC955/MC855, MC956/MC856  
 - 140 mW typ/pkg  
 Propagation Delay Time = 40 ns typ

ASYNCHRONOUS TRUTH TABLE  
 MC952/MC852 and MC955/MC855

S <sub>D</sub>	C <sub>D</sub>	Q	$\bar{Q}$
1	1	NC	NC
0	1	1	0
1	0	0	1
0	0	1	1

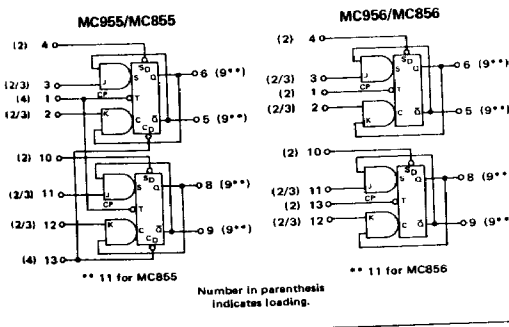
ASYNCHRONOUS TRUTH TABLE  
 MC953/MC853 and MC956/MC856

S <sub>D</sub>	Q	$\bar{Q}$
1	NC	NC
0	1	0

Each section of the monolithic MC955/MC855 and MC956/MC856 dual J-K clocked flip-flops consists of two directly-coupled flip-flops operating on the "master-slave" principle. Input information is stored in the "master" flip-flop when the clock voltage is high and is transferred to the "slave" when the clock voltage goes low.

The MC955/MC855 has a common clock input which makes this device suitable for clocked counters and shift register applications. A common direct clear (C<sub>D</sub>) and separate direct sets (S<sub>D</sub>) are available. The direct inputs override all asynchronous inputs.

The MC956/MC856 has separate clock inputs to each flip-flop, which makes the device suitable for ripple counter applications. Separate direct set inputs which override the synchronous inputs are also provided. The outputs of the flip-flops are buffered, thereby reducing the possibility of circuit disturbance from external line noise. The output pull-up resistor has been changed from that utilized in the MC952/MC852 and MC953/MC853 in order to improve the propagation delay versus capacitance characteristics.



J-K TRUTH TABLE - All Types †

		t <sub>n</sub>		t <sub>n+1</sub>
J	K	Q	$\bar{Q}$	Q
0	0	0	1	Q <sub>n</sub>
1	0	0	1	1
0	1	0	1	0
1	1	0	1	$\bar{Q}_n$

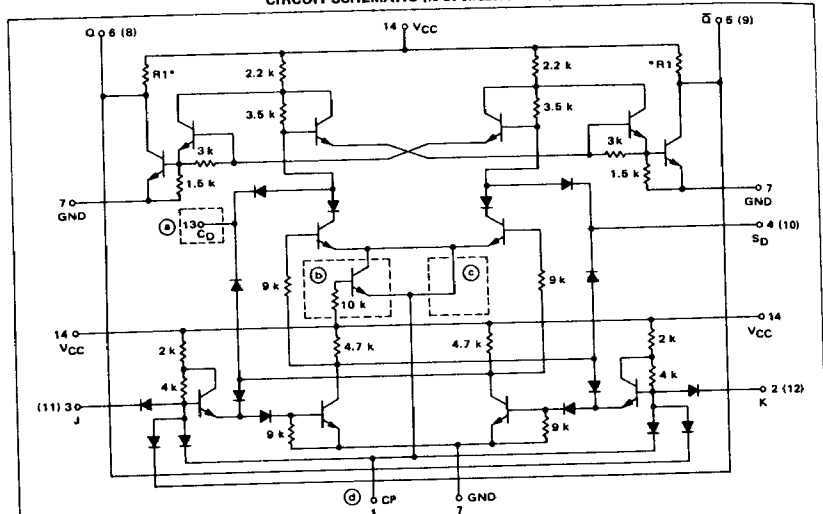
Asynchronous inputs, direct set (S<sub>D</sub>) and direct clear (C<sub>D</sub>), override the synchronous inputs, they are independent of all other inputs.

†Valid only when J and K inputs remain unchanged during period while CP is high.

MC952F/MC852F, P, MC953F/MC853F, P (continued)  
 MC955F/MC855F, P, MC956F/MC856F, P (continued)

C10775

CIRCUIT SCHEMATIC (1/2 of circuit shown)

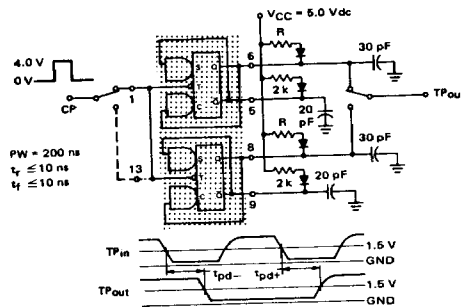


- (\*) Used only on MC952/MC852 and MC955/MC855
- (b) Used only on MC952/MC852 and MC953/MC853
- (c) Used only on MC955/MC855 and MC956/MC856
- (d) Pin 13 used for other side of MC953/MC853 and MC956/MC856

NOTE: Number in parenthesis indicates pin number for other half of the schematic. Ground and VCC pins are common to both sides.

\* MC952/MC852 and MC953/MC853 - 6 k  
 MC955/MC855 and MC956/MC856 - 2 k

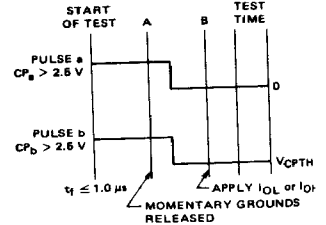
PROPAGATION DELAY TIME TEST  
 CIRCUIT AND WAVEFORMS



Test circuit shown for MC952/MC852 and MC955/MC855.  
 Use dotted-line connection for MC953/MC853 and MC956/MC856, which have separate toggle inputs. Ground pin 7. Only connected inputs are shown. All others are open.  
 MC853 or equivalent used for diodes.

TEST	R
$t_{pd+}$	3.9 k ohms
$t_{pd-}$	400 ohms

CLOCK PULSE WAVEFORMS



TEST CONDITIONS

T <sub>A</sub>	V <sub>CPTH</sub>	
	MC952, MC953	MC955, MC956
-55°C	1.15 V	1.30 V
+25°C	0.95 V	1.15 V
+125°C	0.65 V	0.85 V
V <sub>CPTH</sub>		
0°C	1.00 V	1.20 V
+25°C	0.95 V	1.15 V
+75°C	0.65 V	0.85 V

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MC952F/MC852F, P, MC953F/MC853F, P (continued)  
 MC955F/MC855F, P, MC956F/MC856F, P (continued)

TEST CURRENT / VOLTAGE APPLIED TO PINS LISTED BELOW.

Pin	MC955F, MC956F	MC855F, MC856F	MC953F, MC956F	MC853F, MC856F
$I_{OH}$	14.6	13.0	-0.12	-0.5
$V_{IH}$	1.40	2.10	0	4.00
$V_{CC}$	4.00	5.00	4.00	5.00
$V_{CE}$	4.50	5.50	4.50	5.50
$V_{CO}$	4.50	5.50	4.50	5.50
$V_{OH}$	13.8	12.3	-0.12	-0.5
$V_{OL}$	0.80	2.00	0	4.00
$I_{SC}$	16.8	15.4	-0.12	-0.5
$I_{CC}$	1.20	2.00	0.45	4.00
$I_{CC}$	5.00	5.00	5.00	5.00
$I_{CC}$	18.8	15.4	-0.12	-0.5
$I_{CC}$	1.10	1.80	0.45	4.00
$I_{CC}$	5.00	5.00	5.00	5.00
$I_{CC}$	18.0	14.6	-0.12	-0.5
$I_{CC}$	0.92	1.80	0.50	4.00
$I_{CC}$	5.00	5.00	5.00	5.00

TEST CURRENT / VOLTAGE APPLIED TO PINS LISTED BELOW.

Pin	MC955F, MC956F	MC855F, MC856F	MC953F, MC956F	MC853F, MC856F
$I_{OH}$	14.6	13.0	-0.12	-0.5
$V_{IH}$	1.40	2.10	0	4.00
$V_{CC}$	4.00	5.00	4.00	5.00
$V_{CE}$	4.50	5.50	4.50	5.50
$V_{CO}$	4.50	5.50	4.50	5.50
$V_{OH}$	13.8	12.3	-0.12	-0.5
$V_{OL}$	0.80	2.00	0	4.00
$I_{SC}$	16.8	15.4	-0.12	-0.5
$I_{CC}$	1.20	2.00	0.45	4.00
$I_{CC}$	5.00	5.00	5.00	5.00
$I_{CC}$	18.8	15.4	-0.12	-0.5
$I_{CC}$	1.10	1.80	0.45	4.00
$I_{CC}$	5.00	5.00	5.00	5.00
$I_{CC}$	18.0	14.6	-0.12	-0.5
$I_{CC}$	0.92	1.80	0.50	4.00
$I_{CC}$	5.00	5.00	5.00	5.00



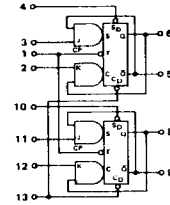
MC953/MC853  
 MC956/MC856  
 ELECTRICAL  
 CHARACTERISTICS

Test procedures are shown for only one flip-flop. The other flip-flop is tested in the same manner.

Characteristic	Symbol	Pin		MC955F, MC956F TEST LIMITS		MC855F, MC856F TEST LIMITS		MC953F, MC956F TEST LIMITS		MC853F, MC856F TEST LIMITS		TEST CURRENT / VOLTAGE APPLIED TO PINS LISTED BELOW.		CP, $\mu$ s	CP, $\mu$ s
		Under	Over	-55°C	+25°C	+25°C	+75°C	-55°C	+25°C	+25°C	+75°C	Min	Max		
Output Voltage	$V_{OH}$	5	5	0.40	1.00	0.45	1.00	0.45	1.00	0.45	1.00	0.45	1.00	0.50	Vdc
	$V_{OL}$	5	5	0.10	0.40	0.10	0.40	0.45	0.45	0.45	0.45	0.45	0.50	Vdc	
Short-Circuit	$I_{SC}$	5	5	-1.45	-2.45	-1.30	-2.25	-1.15	-2.00	-1.25	-2.50	-1.15	-2.00	mAdc	
MC953, MC853		5	5	-1.45	-2.45	-1.30	-2.25	-1.15	-2.00	-1.25	-2.50	-1.15	-2.00	mAdc	
MC956, MC856		5	5	-1.45	-2.45	-1.30	-2.25	-1.15	-2.00	-1.25	-2.50	-1.15	-2.00	mAdc	
Reverse Current	$I_R$	2	3	2.0	2.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	10	$\mu$ Adc	
MC953, MC853		2	3	2.0	2.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	10	$\mu$ Adc	
MC956, MC856		2	3	2.0	2.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	10	$\mu$ Adc	
Forward Current	$I_{FP}$	2	3	-1.07	-1.07	-1.05	-1.00	-0.95	-0.90	-0.95	-0.95	-0.90	0.90	mA	
	$I_{FP}$	3	3	-1.07	-1.07	-1.05	-1.00	-0.95	-0.90	-0.95	-0.95	-0.90	0.90	mA	
	$I_{FP}$	4	4	-1.20	-1.20	-1.20	-1.20	-1.20	-1.20	-1.20	-1.20	-1.20	1.20	mA	
	$I_{FP}$	4	4	-1.20	-1.20	-1.20	-1.20	-1.20	-1.20	-1.20	-1.20	-1.20	1.20	mA	
Power Dissipation	$P_{DIP}$	14	14	32	32	32	32	32	32	32	32	32	32	mW	
MC953, MC853		14	14	32	32	32	32	32	32	32	32	32	32	mW	
MC956, MC856		14	14	32	32	32	32	32	32	32	32	32	32	mW	
Setup/hold Times	$t_{SU}$	14	14	25	100	25	100	25	100	25	100	25	100	ns	
	$t_{HD}$	14	14	15	55	15	55	15	55	15	55	15	55	ns	
	$t_{PH}$	14	14	23	75	23	75	23	75	23	75	23	75	ns	
	$t_{PL}$	14	14	15	55	15	55	15	55	15	55	15	55	ns	

Pin not listed are left open.  
 1. CP<sub>max</sub> = Clock Pulse 1.  
 CP<sub>2</sub> = Clock Pulse 2.  
 2. Applied after Clock Pulse 1.  
 3. Momentary ground.  
 4. See Clock Pulse Waveforms.

MC952F/MC852F, P, MC953F/MC853F, P (continued)  
 MC955F/MC855F, P, MC956F/MC856F, P (continued)



MC952/MC852  
 MC955/MC855  
 ELECTRICAL  
 CHARACTERISTICS

Characteristic	Symbol	Pin Under Test	MC952, MC955 TEST LIMITS						MC852, MC855 TEST LIMITS							
			-55°C		+25°C		+125°C		0°C		+25°C		+75°C			
			Min	Max	Min	Max	Min	Max	Unit	Min	Max	Min	Max	Min	Max	Unit
Output Voltage	$V_{OL}$	5 6 8 9	-	0.40	-	0.40	-	0.45	Vdc	-	0.45	-	0.45	-	0.50	Va
	$V_{OH}$	5 6 8 9	2.50	-	2.80	-	2.50	-	2.60	-	2.60	-	2.50	-	-	-
Short-Circuit Current MC952/MC852	$I_{SC}$	5 6 8 9	-1.45	-2.45	-1.30	-2.25	-1.15	-2.00	mAdc	-1.25	-2.50	-1.15	-2.30	-1.05	-2.15	mA
		MC955/MC855	5 6 8 9	-3.00	-5.10	-2.70	-4.80	-2.40	-4.10	-	-2.60	-5.20	-2.35	-4.75	-2.20	-4.40
Reverse Current All Types	$I_R$	2 3 4 10 11 12	-	2.0	-	2.0	-	5.0	$\mu$ Adc	-	5.0	-	5.0	-	10	$\mu$ A
		All Types	2	-	4.0	-	4.0	-	10	-	10	-	10	-	20	-
		MC952/MC852	2	-	20	-	20	-	40	-	40	-	40	-	60	-
		MC955/MC855	2	-	20	-	20	-	40	-	40	-	40	-	60	-
Forward Current	$I_F$	2 3 11 12	-	-1.07	-	-1.07	-	-1.00	mAdc	-	-0.95	-	-0.95	-	-0.90	mA
		2	-	-6.40	-	-6.40	-	-6.00	-	-5.60	-	-5.60	-	-5.30	-	
		1	-	-6.40	-	-6.40	-	-6.00	-	-5.60	-	-5.60	-	-5.30	-	
		4	-	-3.20	-	-3.20	-	-3.00	-	-2.80	-	-2.80	-	-2.60	-	
10	-	-3.20	-	-3.20	-	-3.00	-	-2.80	-	-2.80	-	-2.60	-			
13	-	-6.40	-	-6.40	-	-6.00	-	-5.60	-	-5.60	-	-5.30	-			
Power Drain Current	$I_{PDH}$ $I_{max}$	MC952/MC852	14	-	-	-	22	-	mAdc	-	-	-	28	-	-	-
		14	-	-	-	32	-	-	-	-	-	36	-	-	-	
		MC955/MC855	14	-	-	-	27	-	-	-	-	-	34	-	-	-
		14	-	-	-	38	-	-	-	-	-	-	45	-	-	-
Switching Times MC952/MC852	$t_{pd+}$ $t_{pd-}$	1,6	-	-	25	100	-	-	ns	-	-	25	100	-	-	-
		1,6	-	-	15	55	-	-	-	-	-	15	55	-	-	-
		1,8	-	-	25	100	-	-	-	-	-	25	100	-	-	-
		1,8	-	-	15	55	-	-	-	-	-	15	55	-	-	-
	MC955/MC855	1,6	-	-	25	75	-	-	-	-	-	25	75	-	-	-
		1,6	-	-	15	55	-	-	-	-	-	15	55	-	-	-
		1,8	-	-	25	75	-	-	-	-	-	25	75	-	-	-
		1,8	-	-	15	55	-	-	-	-	-	15	55	-	-	-

Pins not listed are left open.

$\dagger$   $CP_a$  = Clock Pulse a  
 $\dagger$   $CP_b$  = Clock Pulse b } See Clock Pulse Waveforms.

$\ddagger$  Applied after Clock Pulse.

$\dagger$  Momentary Ground.

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		TEST CURRENT / VOLTAGE VALUES																	
		mA				Volts													
		$I_{OL}$		$I_{OH}$		$V_{IL}$	$V_{IH}$	$V_F$	$V_R$	$V_{CC}$	$V_{CCL}$	$V_{CCH}$	$V_{max}$						
@ Test Temperature		MC952	MC955	MC952	MC955														
MC952, MC955	-55°C	14.6	13.0	-0.12	-0.5	1.40	2.10	0	4.00	4.50	5.50	8.00							
	+25°C	15.2	13.6	-0.12	-0.5	1.10	2.00	0	4.00	5.00	5.00	8.00							
	+125°C	13.8	12.3	-0.12	-0.5	0.80	2.00	0	4.00	4.50	5.50								
MC852, MC855	0°C	16.8	15.4	-0.12	-0.5	1.20	2.00	0.45	4.00	5.00	5.00	8.00							
	+25°C	16.8	15.4	-0.12	-0.5	1.10	1.90	0.45	4.00	5.00	5.00	8.00							
	+75°C	16.0	14.6	-0.12	-0.5	0.95	1.80	0.50	4.00	5.00	5.00								
		TEST CURRENT / VOLTAGE APPLIED TO PINS LISTED BELOW:																	
Characteristic	Symbol	Pin Under Test	$I_{OL}$		$I_{OH}$		$V_{IL}$	$V_{IH}$	$V_F$	$V_R$	$V_{CC}$	$V_{CCL}$	$V_{CCH}$	$V_{max}$	$CP_a$	$CP_b$	Gnd		
Output Voltage	VOL	5†	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,13†		
		6†	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,13†		
		8†	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,10†	
		9†	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,13†	
		5	-	-	5†	3	2	-	-	-	-	-	-	-	-	-	-	4,7	
		6	-	-	5	2,13	4	-	-	-	-	-	-	-	-	-	-	-	7
	VOH	6†	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,13†	
		8†	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	
		9†	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,13†	
		5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	
		6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,13†	
		9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	
No. Current	ISC	5	-	-	-	-	-	-	-	-	-	-	14	-	-	-	5,7		
		6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,7		
		8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,8	
		9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,9	
		5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5,7	
		6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,7	
	MC952 MC852	ISC	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,8	
			6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,9	
			8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5,7	
			9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,7
			5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,8
			6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,9
Max. Current	IR	2	-	-	-	-	-	-	2	-	-	-	14	-	-	-	1,7		
		3	-	-	-	-	-	-	3	-	-	-	-	-	-	-	1,7		
		4	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	2,6,7	
		10	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	7,8,12	
		11	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	1,7	
		12	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-	1,7	
	MC852 MC855	2IR	13	-	-	-	-	-	13	-	-	-	-	-	-	-	-	3,5,7,9,11	
			1	-	-	-	-	-	-	1,14	-	-	-	-	-	-	-	2,3,5,6,7,8,9,11,12	
			1	-	-	-	-	-	-	1	-	-	-	14	-	-	-	2,3,5,6,7,8,9,11,12	
			1	-	-	-	-	-	-	1	-	-	-	14	-	-	-	2,3,5,6,7,8,9,11,12	
			2	-	-	-	-	-	-	2	-	-	-	14	-	-	-	7	
			3	-	-	-	-	-	-	3	-	-	-	14	-	-	-	7	
Forward Current	2/3IF	11	-	-	-	-	-	11	-	-	-	-	-	-	-	-	7		
		12	-	-	-	-	-	12	-	-	-	-	-	-	-	-	7		
		1	-	-	-	-	4,10	1	-	-	-	-	-	-	-	-	2,3,7,13		
		3	-	-	-	-	13	1	-	-	-	-	-	-	-	-	-	1,11,12,13	
		4	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	2,3,4,7	
		10	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-	10,11,12	
	MC852 MC855	2IFCP	13	-	-	-	-	-	13	-	-	-	-	-	-	-	-	7	
			1	-	-	-	-	-	-	1,14	-	-	-	-	-	-	-	2,3,5,6,7,8,9,11,12	
			1	-	-	-	-	-	-	1	-	-	-	14	-	-	-	2,3,5,6,7,8,9,11,12	
			1	-	-	-	-	-	-	1	-	-	-	14	-	-	-	2,3,5,6,7,8,9,11,12	
			2	-	-	-	-	-	-	2	-	-	-	14	-	-	-	7	
			3	-	-	-	-	-	-	3	-	-	-	14	-	-	-	7	
Sustain Current	IPDH	14	-	-	-	-	-	-	-	-	-	14	-	-	-	-	7		
		14	-	-	-	-	-	-	-	-	-	14	-	-	-	-	1,2,3,4,7,10,11,12		
		14	-	-	-	-	-	-	-	-	-	14	-	-	-	-	7		
		14	-	-	-	-	-	-	-	-	-	14	-	-	-	-	1,2,3,4,7,10,11,12		
		14	-	-	-	-	-	-	-	-	-	14	-	-	-	-	7		
		14	-	-	-	-	-	-	-	-	-	14	-	-	-	-	1,2,3,4,7,10,11,12		
	MC852 MC855	IPDH	14	-	-	-	-	-	-	-	-	-	14	-	-	-	-	7	
			14	-	-	-	-	-	-	-	-	-	14	-	-	-	-	1,2,3,4,7,10,11,12	
			14	-	-	-	-	-	-	-	-	-	14	-	-	-	-	7	
			14	-	-	-	-	-	-	-	-	-	14	-	-	-	-	1,2,3,4,7,10,11,12	
			14	-	-	-	-	-	-	-	-	-	14	-	-	-	-	7	
			14	-	-	-	-	-	-	-	-	-	14	-	-	-	-	1,2,3,4,7,10,11,12	
Rising Times	t <sub>pd-</sub>	1,6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7		
		1,6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7		
		1,8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	
		1,8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	
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	MC852 MC855	t <sub>pd-</sub>	1,6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	
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			1,8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	
			1,8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	
			1,8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	

Pins not listed are left open.  
 † V<sub>OL</sub> - Clock Pulse a  
 † V<sub>OH</sub> - Clock Pulse b. See Clock Pulse Waveforms.  
 † Applied after Clock Pulse.  
 † Momentary Ground.

## PRODUCT DOCUMENTATION

The three documents listed in the following table are required for a complete description of the DSP56301 and are necessary to design properly with the part. Documentation is available from one of the following locations (see back cover for detailed information):

- A local Motorola distributor
- A Motorola semiconductor sales office
- A Motorola Literature Distribution Center
- The World Wide Web (WWW)

See the **Additional Support** section of the *DSP56300 Family Manual* for detailed information on the multiple support options available to you.

**Table 1** DSP56301 Documentation

Name	Description	Order Number
DSP56300 Family Manual	Detailed description of the DSP56300 family processor core and instruction set	DSP56300FM/AD
DSP56301 User's Manual	Detailed functional description of the DSP56301 memory configuration, operation, and register programming	DSP56301UM/AD
DSP56301 Technical Data	DSP56301 features list and physical, electrical, timing, and package specifications	DSP56301/D

