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T-46-07-07



# 5473/DM5473/DM7473 Dual Master-Slave J-K Flip-Flops with Clear and Complementary Outputs

## General Description

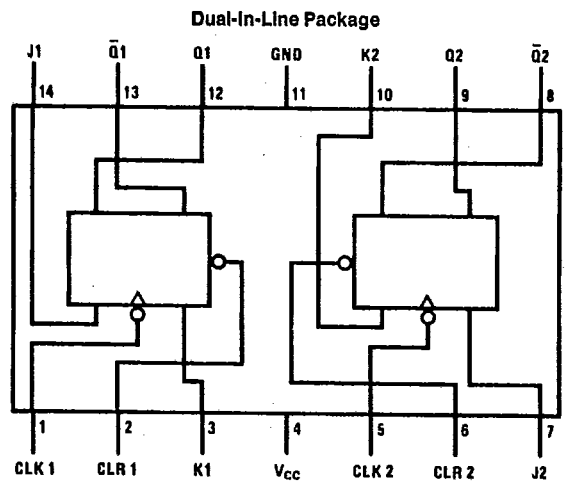
This device contains two independent positive pulse triggered J-K flip-flops with complementary outputs. The J and K data is processed by the flip-flops after a complete clock pulse. While the clock is low the slave is isolated from the master. On the positive transition of the clock, the data from the J and K inputs is transferred to the master. While the clock is high the J and K inputs are disabled. On the negative transition of the clock, the data from the master is transferred to the slave. The logic states of the J and K inputs must not be allowed to change while the clock is high. Data

transfers to the outputs on the falling edge of the clock pulse. A low logic level on the clear input will reset the outputs regardless of the logic states of the other inputs.

## Features

- Alternate Military/Aerospace device (5473) is available. Contact a National Semiconductor Sales Office/Distributor for specifications.

## Connection Diagram



Order Number 5473DMQB, 5473FMQB, DM5473J, DM5473W or DM7473N  
See NS Package Number J14A, N14A or W14B

## Function Table

Inputs				Outputs	
CLR	CLK	J	K	Q	Q̄
L	X	X	X	L	H
H	⌋	L	L	Q <sub>0</sub>	Q̄ <sub>0</sub>
H	⌋	H	L	H	L
H	⌋	L	H	L	H
H	⌋	H	H	Toggle	

H = High Logic Level  
L = Low Logic Level  
X = Either Low or High Logic Level  
⌋ = Positive pulse data, the J and K inputs must be held constant while the clock is high. Data is transferred to the outputs on the falling edge of the clock pulse.  
Q<sub>0</sub> = The output logic level before the indicated input conditions were established.  
Toggle = Each output changes to the complement of its previous level on each high level clock pulse.

T-46-07-07.

**Absolute Maximum Ratings** (Note)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage	7V
Input Voltage	5.5V
Operating Free Air Temperature Range	
DM54 and 54	-55°C to +125°C
DM74	0°C to +70°C
Storage Temperature Range	-65°C to +150°C

Note: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

**Recommended Operating Conditions**

Symbol	Parameter	DM5473			DM7473			Units
		Min	Nom	Max	Min	Nom	Max	
V <sub>CC</sub>	Supply Voltage	4.5	5	5.5	4.75	5	5.25	V
V <sub>IH</sub>	High Level Input Voltage	2			2			V
V <sub>IL</sub>	Low Level Input Voltage			0.8			0.8	V
I <sub>OH</sub>	High Level Output Current			-0.4			-0.4	mA
I <sub>OL</sub>	Low Level Output Current			16			16	mA
f <sub>CLK</sub>	Clock Frequency (Note 5)	0		15	0		15	MHz
t <sub>w</sub>	Pulse Width (Note 5)	Clock High	20		20			ns
		Clock Low	47		47			
		Clear Low	25		25			
t <sub>su</sub>	Input Setup Time (Note 1 & 5)	0 ↑			0 ↑			ns
t <sub>h</sub>	Input Hold Time (Note 1 & 5)	0 ↓			0 ↓			ns
T <sub>A</sub>	Free Air Operating Temperature	-55		125	0		70	°C

**Electrical Characteristics**

over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 2)	Max	Units
V <sub>I</sub>	Input Clamp Voltage	V <sub>CC</sub> = Min, I <sub>I</sub> = -12 mA			-1.5	V
V <sub>OH</sub>	High Level Output Voltage	V <sub>CC</sub> = Min, I <sub>OH</sub> = Max V <sub>IL</sub> = Max, V <sub>IH</sub> = Min	2.4	3.4		V
V <sub>OL</sub>	Low Level Output Voltage	V <sub>CC</sub> = Min, I <sub>OL</sub> = Max V <sub>IH</sub> = Min, V <sub>IL</sub> = Max		0.2	0.4	V
I <sub>I</sub>	Input Current @ Max Input Voltage	V <sub>CC</sub> = Max, V <sub>I</sub> = 5.5V			1	mA
I <sub>IH</sub>	High Level Input Current	V <sub>CC</sub> = Max V <sub>I</sub> = 2.4V	J, K		40	μA
			Clock		80	
			Clear		80	
I <sub>IL</sub>	Low Level Input Current	V <sub>CC</sub> = Max V <sub>I</sub> = 0.4V	J, K		-1.6	mA
			Clock		-3.2	
			Clear		-3.2	
I <sub>OS</sub>	Short Circuit Output Current	V <sub>CC</sub> = Max (Note 3)	DM54	-20	-55	mA
			DM74	-18	-55	
I <sub>CC</sub>	Supply Current	V <sub>CC</sub> = Max, (Note 4)		18	34	mA

- Note 1: The symbol (↑, ↓) indicates the edge of the clock pulse is used for reference: (↑) for rising edge, (↓) for falling edge.
- Note 2: All typicals are at V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C.
- Note 3: Not more than one output should be shorted at a time.
- Note 4: With all outputs open, I<sub>CC</sub> is measured with the Q and  $\bar{Q}$  outputs high in turn. At the time of measurement the clock input grounded.
- Note 5: T<sub>A</sub> = 25°C and V<sub>CC</sub> = 5V.



**Switching Characteristics** at  $V_{CC} = 5V$  and  $T_A = 25^\circ C$  (See Section 1 for Test Waveforms and Output Load)

Symbol	Parameter	From (Input) To (Output)	$R_L = 400\Omega$ $C_L = 15 pF$		Units
			Min	Max	
$f_{MAX}$	Maximum Clock Frequency		15		MHz
$t_{PHL}$	Propagation Delay Time High to Low Level Output	Clear to Q		40	ns
$t_{PLH}$	Propagation Delay Time Low to High Level Output	Clear to $\bar{Q}$		25	ns
$t_{PHL}$	Propagation Delay Time High to Low Level Output	Clock to Q or $\bar{Q}$		40	ns
$t_{PLH}$	Propagation Delay Time Low to High Level Output	Clock to Q or $\bar{Q}$		25	ns