



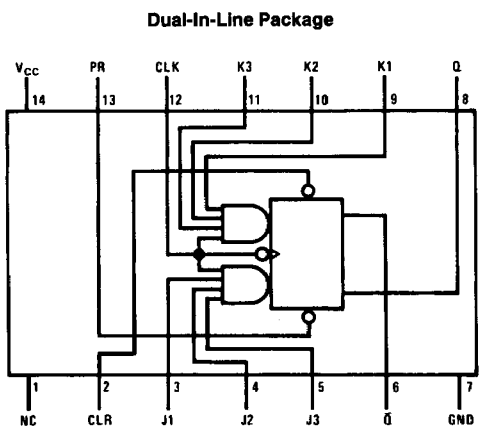
## DM54L72 AND-Gated Master-Slave J-K Flip-Flop with Preset, Clear and Complementary Outputs

### General Description

This device contains a positive pulse triggered master-slave J-K flip-flop with complementary outputs. Multiple J and K inputs are ANDed together to produce the internal J and K function for the flip-flop. The J and K data is processed by the flip-flop 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 AND gates is transferred to the master. While the clock is high the AND gate

inputs are disabled. On the negative transition of the clock the data from the master is transferred to the slave. The logic state of the J and K inputs must not be allowed to change while the clock is in the high state. Data is transferred to the outputs on the falling edge of the clock pulse. A low logic level on the preset or clear inputs sets or resets the outputs regardless of the logic levels of the other inputs.

### Connection Diagram



TL/F/6629-1

Order Number DM54L72J or DM54L72W  
See NS Package Number J14A or W14B

### Function Table

Inputs					Outputs	
PR	CLR	CLK	J (Note 1)	K (Note 1)	Q	$\bar{Q}$
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	Q <sub>o</sub>	$\bar{Q}$ <sub>o</sub>
H	H	┐	H	L	H	L
H	H	┌	L	H	L	H
H	H	┐	H	H	Toggle	Toggle

Note 1: J = (J1)(J2)(J3), K = (K1)(K2)(K3)

H = High Logic Level

X = Either Low or High Logic Level

L = Low Logic Level

┌ = Positive pulse. 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>o</sub> = The output logic level before the indicated input conditions were established.

\* = This configuration is nonstable; that is, it will not persist when the preset and/or clear inputs return to their inactive (high) level.

Toggle = Each output changes to the complement of its previous level on each complete high level clock pulse.

## 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	8V
Input Voltage	5.5V
Operating Free Air Temperature Range	
DM54L	-55°C to +125°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		DM54L72			Units
			Min	Nom	Max	
V <sub>CC</sub>	Supply Voltage		4.5	5	5.5	V
V <sub>IH</sub>	High Level Input Voltage		2			V
V <sub>IL</sub>	Low Level Input Voltage	Clock			0.6	V
		Others			0.7	
I <sub>OH</sub>	High Level Output Current				-0.2	mA
I <sub>OL</sub>	Low Level Output Current				2	mA
f <sub>CLK</sub>	Clock Frequency (Note 2)		0		6	MHz
t <sub>w</sub>	Pulse Width (Note 2)	Clock High	100			ns
		Clock Low	100			
		Preset Low	100			
		Clear Low	100			
t <sub>SU</sub>	Input Setup Time (Notes 1 & 2)		0 ↑			ns
t <sub>H</sub>	Input Hold Time (Notes 1 & 2)		0 ↓			ns
T <sub>A</sub>	Free Air Operating Temperature		-55		125	°C

**Note 1:** The symbols (↑, ↓) indicate the edge of the clock pulse used for reference: ↑ for rising edge, ↓ for falling edge.

**Note 2:** T<sub>A</sub> = 25°C and V<sub>CC</sub> = 5V.

## Electrical Characteristics

over recommended operating free air temperature (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 1)	Max	Units
$V_{OH}$	High Level Output Voltage	$V_{CC} = \text{Min}, I_{OH} = \text{Max}$ $V_{IL} = \text{Max}, V_{IH} = \text{Min}$	2.4	3.3		V
$V_{OL}$	Low Level Output Voltage	$V_{CC} = \text{Min}, I_{OL} = \text{Max}$ $V_{IL} = \text{Max}, V_{IH} = \text{Min}$		0.15	0.3	V
$I_I$	Input Current @ Max Input Voltage	$V_{CC} = \text{Max}$ $V_I = 5.5V$	J, K		100	$\mu A$
			Clear		200	
			Preset		200	
			Clock		200	
$I_{IH}$	High Level Input Current	$V_{CC} = \text{Max}$ $V_I = 2.4V$	J, K		10	$\mu A$
			Clear		20	
			Preset		20	
			Clock		-200	
$I_{IL}$	Low Level Input Current	$V_{CC} = \text{Max}$ $V_I = 0.3V$	J, K		-0.18	mA
			Clear		-0.36	
			Preset		-0.36	
			Clock		-0.36	
$I_{OS}$	Short Circuit Output Current	$V_{CC} = \text{Max}$	-3		-15	mA
$I_{CC}$	Supply Current	$V_{CC} = \text{Max}$ (Note 2)		0.76	1.44	mA

Note 1: All typicals are at  $V_{CC} = 5V$ ,  $T_A = 25^\circ C$ .

Note 2: With all outputs open,  $I_{CC}$  is measured with the Q and  $\bar{Q}$  outputs high in turn. At the time of measurement the clock input is grounded.

## 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)	$R_L = 4\text{ k}\Omega, C_L = 50\text{ pF}$		Units
			Min	Max	
$f_{MAX}$	Maximum Clock Frequency		6		MHz
$t_{PLH}$	Propagation Delay Time Low to High Level Output	Preset to Q		75	ns
$t_{PHL}$	Propagation Delay Time High to Low Level Output	Preset to $\bar{Q}$		150	ns
$t_{PLH}$	Propagation Delay Level Output Low to High Level Output	Clear to $\bar{Q}$		75	ns
$t_{PHL}$	Propagation Delay Time High to Low Level Output	Clear to Q		150	ns
$t_{PLH}$	Propagation Delay Time Low to High Level Output	Clock to Q or $\bar{Q}$	10	75	ns
$t_{PHL}$	Propagation Delay Time High to Low Level Output	Clock to Q or $\bar{Q}$	10	150	ns