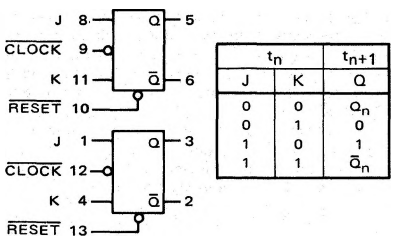
DUAL J-K FLIP-FLOP

# MC54107L*
# MC74107P, L*




| $t_n$ | | $t_{n+1}$ |
|---|---|---|
| J | K | Q |
| 0 | 0 | $Q_n$ |
| 0 | 1 | 0 |
| 1 | 0 | 1 |
| 1 | 1 | $\bar{Q}_n$ |

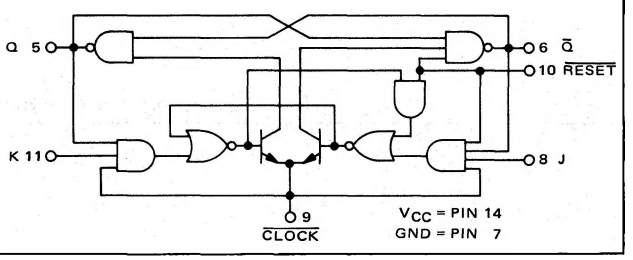
Input Loading Factor:
J, K = 1
$\overline{\text{RESET}}$, $\overline{\text{CLOCK}}$ = 2

Output Loading Factor = 10

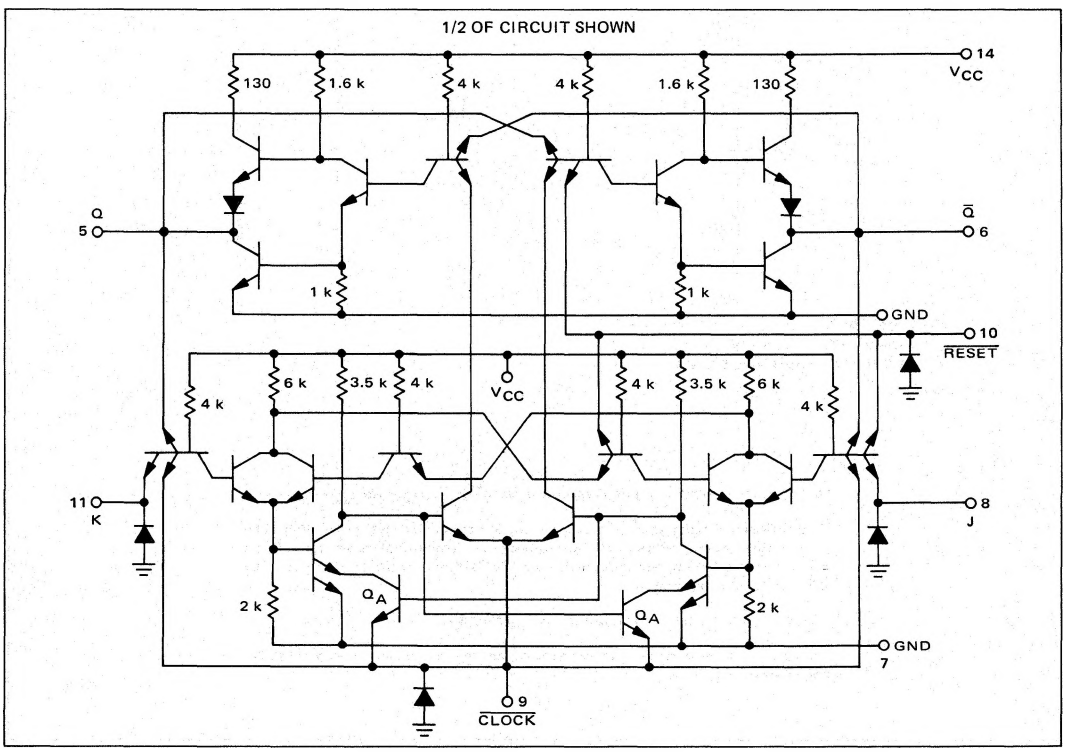
Total Power Dissipation = 80 mW typ/pkg
Propagation Delay Time = 30 ns typ
Operating Frequency = 15 MHz typ

This negative-edge-clocked dual J-K flip-flop operates on the master-slave principle. The device is quite useful for simple registers and counters where multiple J and K inputs are not required.

**LOGIC DIAGRAM**
(1/2 OF DEVICE SHOWN)




*L suffix = TO-116 ceramic package (Case 632)
P suffix = TO-116 plastic package (Case 605)
See General Information section for package outline dimensions.



## OPERATING CHARACTERISTICS

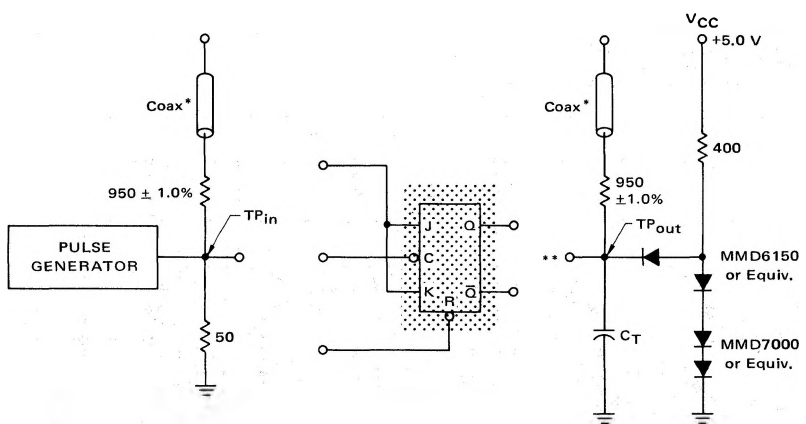
Data must be applied to the J-K inputs while the clock is low. When the clock input goes to the positive logic "1" state, the data at the J and K inputs is transferred to the master section, where it is stored until the clock changes to the positive logic "0" state. Data at the J and K inputs must not be changed while the clock is high. When the clock returns to the positive logic "0" state, information in the master section is transferred to the slave section.

Application of a logic "0" to the $\overline{\text{RESET}}$ input will force the $\overline{Q}$ output to the logic "1" state. The $\overline{\text{RESET}}$ input overrides the clock.

Since no charge storage is involved in this flip-flop, rise and fall times are not important to its operation. Clock fall times as long as 1.0 μs will not adversely affect the operation of the flip-flop. The clock pulse need only be wide enough to allow the data to settle in the master section. This time, which is the setup time for a logic "1", is 20 ns minimum.

Transistors $Q_A$ have been added to the standard flip-flop circuit to protect the device against negative clock transients. This addition prevents both outputs from changing to the logic "1" state when transients in excess of -2.0 V appear at the clock.

### SWITCHING TIME TEST CIRCUIT




$t_- = t_+ \leq 5.0$ ns

f = 10 MHz for waveform A
1.0 MHz for waveforms B and C

Two pulse generators are required and must be slaved together for $t_{sd}$ tests.

* The coax delays from input to scope and output to scope must be matched. The scope must be terminated in 50-ohm impedance. The 950-ohm resistor and the scope termination impedance constitute a 20:1 attenuator probe. Coax shall be CT-070-50 or equivalent.

** A load is connected to each output during the test.

$C_T$ = 15 pF = total parasitic capacitance, which includes probe, wiring, and load capacitances.

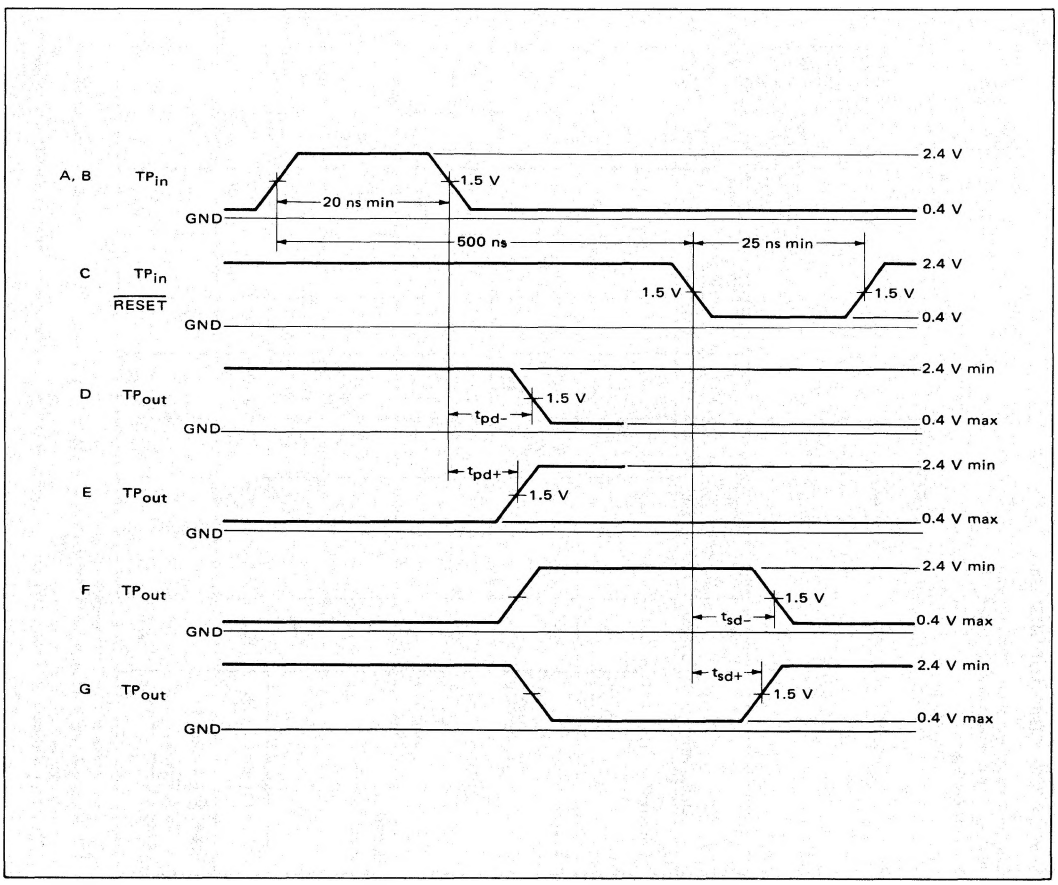
## TEST PROCEDURES

(Letters shown in test columns refer to waveforms.)

| TEST | SYMBOL | INPUT | | | Q | $\bar{Q}$ | LIMITS | | |
|---|---|---|---|---|---|---|---|---|---|
| | | $\bar{C}$ | J, K | $\bar{R}$ | | | Min | Max | Unit |
| Toggle Frequency | $f_{Tog}$ | A | A | 2.4 V | † | † | 10 | – | MHz |
| Turn-On Delay | $t_{pd-}$ | B | B | 2.4 V | D | D | 10 | 50 | ns |
| Turn-Off Delay | $t_{pd+}$ | B | B | 2.4 V | E | E | 10 | 50 | ns |
| Turn-On Delay | $t_{sd-}$ | B | B | C | F | – | – | 50 | ns |
| Turn-Off Delay | $t_{sd+}$ | B | B | C | – | G | – | 50 | ns |
| Enable Voltage | $V_{EN}$ | B | 2.0 V | 2.4 V | † | † | † | – | – |
| Inhibit Voltage | $V_{INH}$ | B | 0.8 V | 2.4 V | ‡ | ‡ | ‡ | – | – |

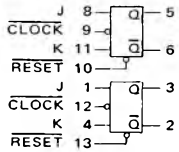
†Output shall toggle with each input pulse.
‡Output shall NOT toggle.

## VOLTAGE WAVEFORMS AND DEFINITIONS



## ELECTRICAL CHARACTERISTICS

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




| | TEST CURRENT/VOLTAGE VALUES (All Temperatures) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mA | | Volts | | | | | | | | | | |
| | $I_{OL}$ | $I_{OH}$ | $V_{IL}$ | $V_{IH}$ | $V_{IHH}$ | $V_R$ | $V_{th1}$ | $V_{th0}$ | $V_{CC}$ | $V_{CCL}$ | $V_{CCH}$ | | |
| MC54107 | 16 | -0.4 | 0.4 | 2.4 | 5.5 | 4.5 | 2.0 | 0.8 | 5.0 | 4.5 | 5.5 | | |
| MC74107 | 16 | -0.4 | 0.4 | 2.4 | 5.5 | 4.5 | 2.0 | 0.8 | 5.0 | 4.75 | 5.25 | | |

| Characteristic | Symbol | Pin Under Test | MC54107 Test Limits −55 to +125°C Min | Max | Unit | MC74107 Test Limits 0 to +70°C Min | Max | Unit | TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW: $I_{OL}$ | $I_{OH}$ | $V_{IL}$ | $V_{IH}$ | $V_{IHH}$ | $V_R$ | $V_{th1}$ | $V_{th0}$ | $V_{CC}$ | $V_{CCL}$ | $V_{CCH}$ | ** | Gnd |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Input** | | | | | | | | | | | | | | | | | | | | | |
| Forward Current J | $I_F$ | 8 | - | -1.6 | mAdc | - | -1.6 | mAdc | - | - | 8 | - | - | 9,10 | - | - | - | - | 14 | 5 | 7* |
| K | | 11 | - | -1.6 | ↓ | - | -1.6 | ↓ | - | - | 11 | - | - | 9,10 | - | - | - | - | ↓ | 6 | 7* |
| $\overline{\text{Reset}}$ | | 10 | - | -3.2 | | - | -3.2 | | - | - | 10 | - | - | 8,9 | - | - | - | - | | - | 7* |
| $\overline{\text{Clock}}$ | | 9 | - | -3.2 | ↓ | - | -3.2 | ↓ | - | - | 9 | - | - | 2,3,14 | - | - | - | - | ↓ | 10 | 7* |
| Leakage Current J | $I_{R1}$ | 8 | - | 40 | μAdc | - | 40 | μAdc | - | - | - | 8 | - | - | - | - | - | - | 14 | - | 7,9,10* |
| K | | 11 | - | 40 | | - | 40 | | - | - | - | 11 | - | 10 | - | - | - | - | ↓ | 10 | 7,9* |
| $\overline{\text{Reset}}$ | | 10 | - | 80 | | - | 80 | | - | - | - | 10 | - | - | - | - | - | - | | - | 7,8,9* |
| $\overline{\text{Clock}}$ | | 9 | - | 80 | ↓ | - | 80 | ↓ | - | - | - | 9 | - | - | - | - | - | - | ↓ | - | 7,8,10,11* |
| J | $I_{R2}$ | 8 | - | 1.0 | mAdc | - | 1.0 | mAdc | - | - | - | - | 8 | - | - | - | - | - | 14 | - | 7,9,10* |
| K | | 11 | - | ↓ | ↓ | - | ↓ | ↓ | - | - | - | - | 11 | 10 | - | - | - | - | ↓ | 10 | 7,9* |
| $\overline{\text{Reset}}$ | | 10 | - | | | - | | | - | - | - | - | 10 | - | - | - | - | - | | - | 7,8,9* |
| $\overline{\text{Clock}}$ | | 9 | - | ↓ | ↓ | - | ↓ | ↓ | - | - | - | - | 9 | - | - | - | - | - | ↓ | - | 7,8,10,11* |
| **Output** | | | | | | | | | | | | | | | | | | | | | |
| Output Voltage | $V_{OL}$ | 5 | - | 0.4 | Vdc | - | 0.4 | Vdc | 5 | - | - | - | - | - | - | 10 | - | 14 | - | - | 7,8,9,11* |
| | | 6 | - | 0.4 | Vdc | - | 0.4 | Vdc | 6 | - | - | - | - | - | 10 | - | - | 14 | - | 6 | 7,8,9,11* |
| | $V_{OH}$ | 5 | 2.4 | - | Vdc | 2.4 | - | Vdc | - | 5 | - | - | - | - | 10 | - | - | 14 | - | 6 | 7,8,9,11* |
| | | 6 | 2.4 | - | Vdc | 2.4 | - | Vdc | - | 6 | - | - | - | - | - | 10 | - | 14 | - | - | 7,8,9,11* |
| Short-Circuit Current | $I_{SC}$ | 5 | -20 | -57 | mAdc | -18 | -57 | mAdc | - | - | - | 8,9,11 | - | - | - | - | - | - | 14 | 6 | 5,7* |
| | | 6 | -20 | -57 | mAdc | -18 | -57 | mAdc | - | - | - | 8,9,11 | - | - | - | - | - | - | 14 | - | 6,7,10* |
| **Power Requirements (Total Device)** | | | | | | | | | | | | | | | | | | | | | |
| Power Supply Drain | $I_{PD}$ | 14 | - | 32 | mAdc | - | 32 | mAdc | - | - | - | - | - | - | - | - | 14 | - | - | - | 7,10,13 |
| | | 14 | - | 32 | mAdc | - | 32 | mAdc | - | - | - | - | - | - | - | - | 14 | - | - | 2,6 | 7 |

*Ground inputs to flip-flop not under test.

**Momentarily ground pin prior to taking measurement to set flip-flop in the desired state. (If pin is also in another column, the pin must be returned to that voltage or current for measurement.)

‡Test duration ≤ 100 ms.

†Under normal operating conditions this current is negative. This test guarantees that positive leakage current will not exceed the limit shown.