

KS54AHCT 109
KS74AHCT

Dual J-K Positive Edge-Triggered Flip-Flops with Preset and Clear

T-46-07-07

FEATURES

- Function, pin-out, speed and drive compatibility with 54/74ALS logic family
- Low power consumption characteristic of CMOS
- High-Drive Current outputs:
I_{OL} = 8 mA @ V_{OL} = 0.5V
- Inputs and outputs interface directly with TTL, NMOS and CMOS devices
- Wide operating voltage range: 4.5V to 5.5V
- Characterized for operation over industrial and military temperature ranges:
KS74AHCT: -40°C to +85°C
KS54AHCT: -55°C to +125°C
- Package options include plastic "small outline" packages, standard plastic and ceramic 300-mil DIPs

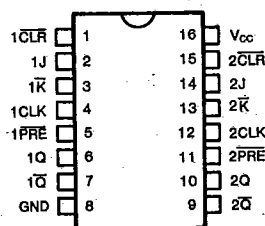
DESCRIPTION

These devices contain two positive-edge-triggered J-K flip-flops with independent preset and clear inputs and complementary Q and Q̄ outputs. The present and clear inputs are active-low and operate independently of the clock. Data at the J and K inputs are transferred to the outputs on the positive transition of the clock provided setup requirements have been met. These versatile flip-flops can perform as toggle flip-flops by grounding K and tying J high. They can also perform as D-type flops if J and K are tied together.

These devices provide speeds and drive capability equivalent to their ALSTL counterparts and yet maintain CMOS power levels. The input and output voltage levels allow direct interface with TTL, NMOS and CMOS devices without any external components.

All inputs and outputs are protected from damage due to static discharge by internal diode clamps to V_{CC} and ground.

PIN CONFIGURATION

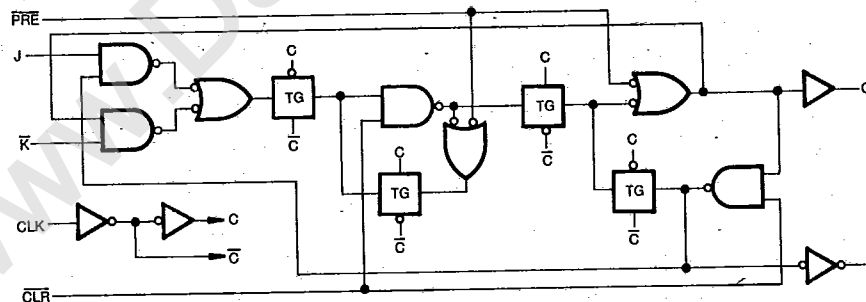


FUNCTION TABLE

| Inputs | | | | | Outputs | |
|--------|-----|-----|---|---|----------------|-----------------|
| PRE | CLR | CLK | J | K | Q | Q̄ |
| 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 | L | H |
| H | H | ↑ | H | L | TOGGLE | TOGGLE |
| H | H | ↑ | L | H | Q ₀ | Q̄ ₀ |
| H | H | ↑ | H | H | H | L |
| H | H | L | X | X | Q ₀ | Q̄ ₀ |

*Both outputs will remain high as long as PRE and CLR are low, but the output states are unpredictable if PRE and CLR go high simultaneously.

LOGIC DIAGRAM



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Absolute Maximum Ratings*

- Supply Voltage Range V_{CC} , -0.5V to +7V
- DC Input Diode Current, I_{IK}
 $(V_I < -0.5V \text{ or } V_I > V_{CC} + 0.5V)$ ± 20 mA
- DC Output Diode Current, I_{OK}
 $(V_O < -0.5V \text{ or } V_O > V_{CC} + 0.5V)$ ± 20 mA
- Continuous Output Current Per Pin, I_O
 $(-0.5V < V_O < V_{CC} + 0.5V)$ ± 35 mA
- Continuous Current Through
 V_{CC} or GND pins ± 125 mA
- Storage Temperature Range, T_{stg} -65°C to +150°C
- Power Dissipation Per Package, P_d [†] 500 mW

* Absolute Maximum Ratings are those values beyond which permanent damage to the device may occur. These are stress ratings only and functional operation of the device at or beyond them is not implied. Long exposure to these conditions may affect device reliability.

- † Power Dissipation temperature derating:
 Plastic Package (N): -12mW/°C from 65°C to 85°C
 Ceramic Package (J): -12mW/°C from 100°C to 125°C

Recommended Operating Conditions

- Supply Voltage, V_{CC} 4.5V to 5.5V
- DC Input & Output Voltages*, V_{IN}, V_{OUT} 0V to V_{CC}
- Operating Temperature
 Range KS74AHCT: -40°C to +85°C
 KS54AHCT: -55°C to +125°C
- Input Rise & Fall Times, t_r, t_f Max 500 ns

* Unused inputs must always be tied to an appropriate logic voltage level (either V_{CC} or GND)

DC ELECTRICAL CHARACTERISTICS ($V_{CC}=5V \pm 10\%$ Unless Otherwise Specified)

| Characteristic | Symbol | Test Conditions | $T_a = 25^\circ\text{C}$ | | | Unit | |
|--------------------------------------|-----------------|--------------------------------------------------------------------------------------------------|--------------------------|------------------------|------------------------|-----------------------|---------------|
| | | | Typ | Guaranteed Limits | | | |
| Minimum High-Level Input Voltage | V_{IH} | | | 2.0 | 2.0 | 2.0 | V |
| Maximum Low-Level Input Voltage | V_{IL} | | | 0.8 | 0.8 | 0.8 | V |
| Minimum High-Level Output Voltage | V_{OH} | $V_{IN}=V_{IH}$ or V_{IL} $I_O = -20\mu\text{A}$ $I_O = -4\text{mA}$ | V_{CC} 4.2 | $V_{CC} - 0.1$ 3.98 | $V_{CC} - 0.1$ 3.84 | $V_{CC} - 0.1$ 3.7 | V |
| Maximum Low-Level Output Voltage | V_{OL} | $V_{IN}=V_{IH}$ or V_{IL} $I_O = 20\mu\text{A}$ $I_O = 4\text{mA}$ $I_O = 8\text{mA}$ | 0 | 0.1 0.26 0.39 | 0.1 0.33 0.5 | 0.1 0.4 | V |
| Maximum Input Current | I_{IN} | $V_{IN}=V_{CC}$ or GND | | ± 0.1 | ± 1.0 | ± 1.0 | μA |
| Maximum Quiescent Supply Current | I_{CC} | $V_{IN}=V_{CC}$ or GND $I_{OUT}=0\mu\text{A}$ | | 4.0 | 40.0 | 80.0 | μA |
| Additional Worst Case Supply Current | ΔI_{CC} | per input pin $V_I = 2.4V$ other inputs: at V_{CC} or GND $I_{OUT}=0\mu\text{A}$ | | 2.7 | 2.9 | 3.0 | mA |

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AC ELECTRICAL CHARACTERISTICS (Input $t_r, t_f \leq 2$ ns), AHCT109

| Characteristic | Symbol | Conditions† | KS74AHCT | | KS54AHCT | | Unit | | |
|----------------------------------------------------|---------------------|---------------------|----------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----|------|-----|----|
| | | | $T_a = 25^\circ\text{C}$ $V_{CC} = 5.0\text{V}$ | $T_a = -40^\circ\text{C to } +85^\circ\text{C}$ $V_{CC} = 5.0\text{V} \pm 10\%$ | $T_a = -55^\circ\text{C to } +125^\circ\text{C}$ $V_{CC} = 5.0\text{V} \pm 10\%$ | | | | |
| | | | Typ | Min | Max | Min | Max | | |
| Maximum Clock Frequency | f_{max} | $C_L = 50\text{pF}$ | 55 | 34 | | 30 | | MHz | |
| Propagation Delay, CLK to Q or \bar{Q} | t_{PLH} | | 10 | | 17 | | 20 | | ns |
| | t_{PHL} | | 10 | | 17 | | 20 | | ns |
| Propagation Delay, PRE or CLR to Q or \bar{Q} | t_{PLH} | | 10 | | 17 | | 20 | | ns |
| | t_{PHL} | | 10 | | 17 | | 20 | | ns |
| Setup Time before CLK† | Data | | t_{su} | 7 | 12 | | 15 | | ns |
| | PRE or CLR Inactive | | 5 | 8 | | 10 | | ns | |
| Hold Time, Data after CLK† | | t_{h} | -3 | 0 | | 0 | | ns | |
| Pulse Width | CLK High or Low | t_{w} | 9 | 15 | | 17 | | ns | |
| | PRE or CLR Low | | 9 | 15 | | 17 | | ns | |
| Input Capacitance | | C_{IN} | 5 | | | | | pF | |
| Power Dissipation Capacitance* | | C_{PD} | | | | | | pF | |

* C_{PD} determines the no-load dynamic power dissipation: $P_D = C_{\text{PD}} V_{CC}^2 f + I_{CC} V_{CC}$.

† For AC switching test circuits and timing waveforms see section 2.

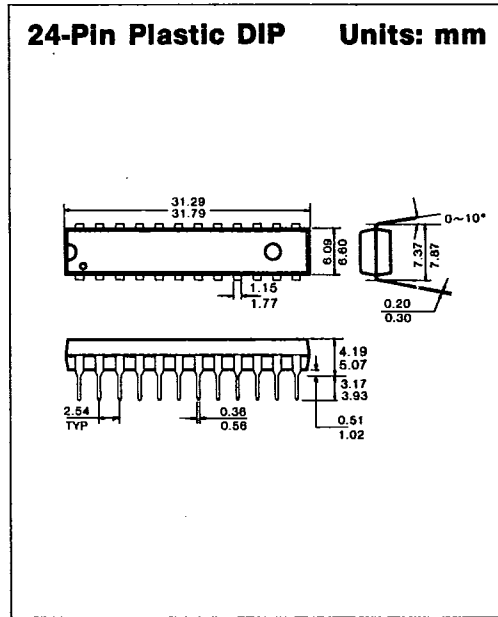
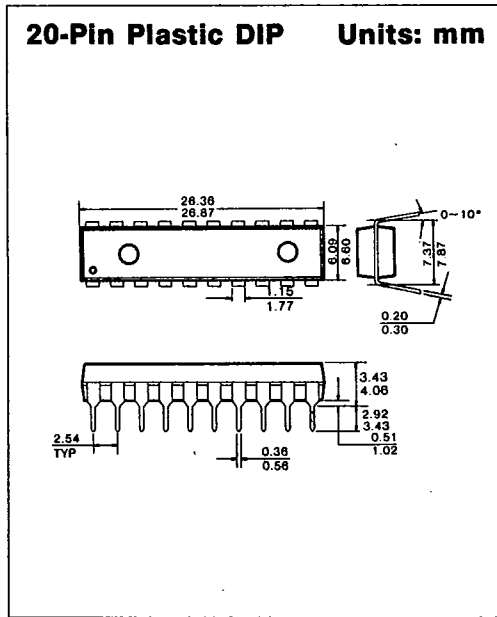
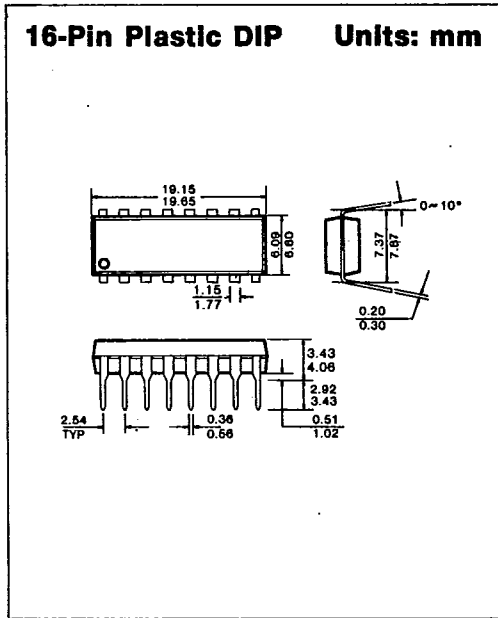
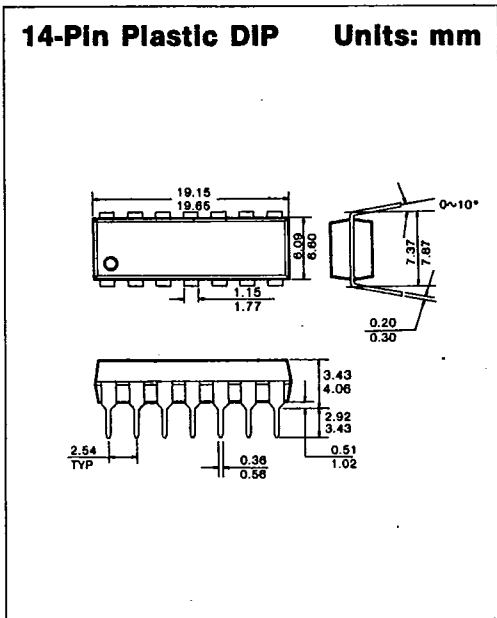
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PACKAGE DIMENSIONS

T-90-20

1. PLASTIC PACKAGES



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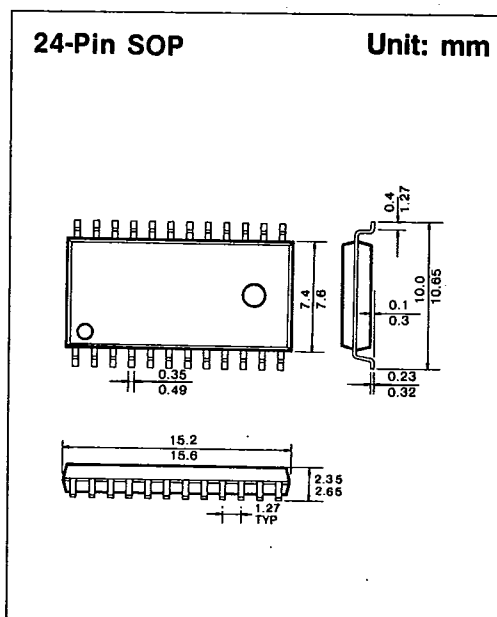
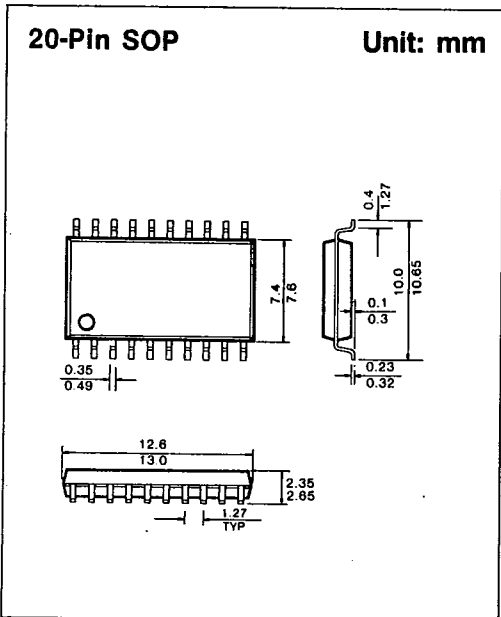
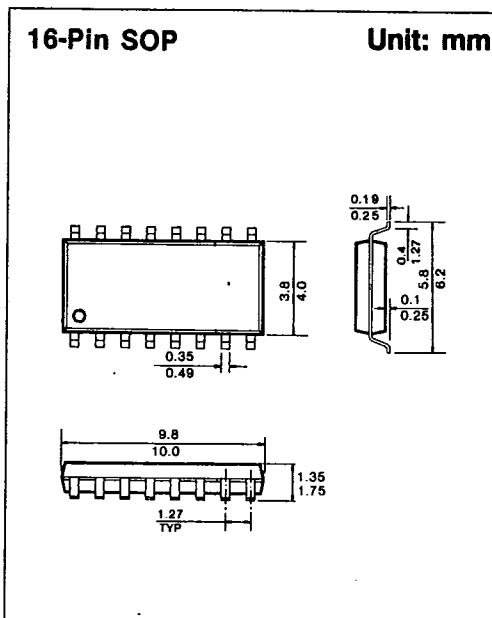
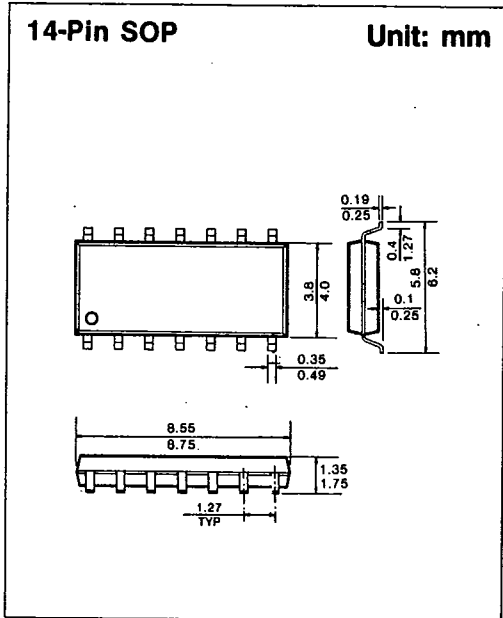
SAMSUNG SEMICONDUCTOR

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PACKAGE DIMENSIONS

T-90-20

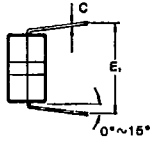
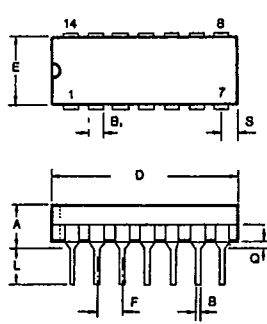


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T-90-20

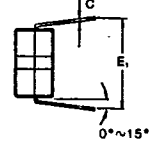
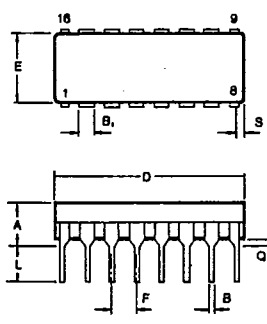
2. CERAMIC PACKAGES

14-Pin Ceramic DIP Units: mm



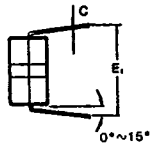
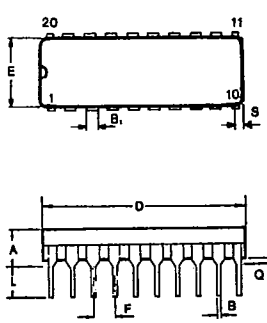
| Dim | Millimeters | |
|-----|-------------|-------|
| | Min | Max |
| A | — | 5.08 |
| B | 0.38 | 0.58 |
| B1 | 1.40 | 1.78 |
| C | 0.20 | 0.38 |
| D | 18.16 | 19.58 |
| E | 8.10 | 7.49 |
| E1 | 7.62 | 10.03 |
| F | 2.54 | |
| L | 3.18 | 4.19 |
| Q | 0.51 | 1.02 |
| S | 1.91 | 2.29 |

16-Pin Ceramic DIP Units: mm



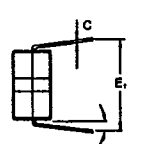
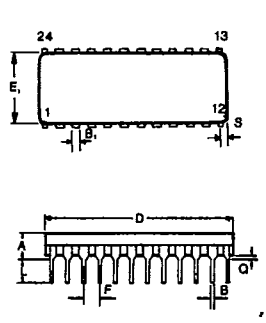
| Dim | Millimeters | |
|-----|-------------|-------|
| | Min | Max |
| A | — | 5.08 |
| B | 0.38 | 0.58 |
| B1 | 1.40 | 1.78 |
| C | 0.20 | 0.38 |
| D | 19.05 | 19.94 |
| E | 8.10 | 7.49 |
| E1 | 7.62 | 10.03 |
| F | 2.54 | |
| L | 3.18 | 4.19 |
| Q | 0.51 | 1.02 |
| S | 0.51 | 1.14 |

20-Pin Ceramic DIP Units: mm



| Dim | Millimeters | |
|-----|-------------|-------|
| | Min | Max |
| A | 4.06 | 5.08 |
| B | 0.38 | 0.53 |
| B1 | 1.14 | 1.52 |
| C | 0.20 | 0.38 |
| D | 25.78 | 26.93 |
| E | 8.10 | 8.60 |
| E1 | 7.77 | 7.88 |
| F | 2.54 | |
| L | 3.73 | 4.01 |
| Q | 0.38 | 0.89 |
| S | 0.51 | 1.14 |

24-Pin Ceramic DIP Units: mm



| Dim | Millimeters | |
|-----|-------------|-------|
| | Min | Max |
| A | 4.06 | 5.08 |
| B | 0.38 | 0.53 |
| B1 | 1.14 | 1.52 |
| C | 0.20 | 0.38 |
| D | 31.50 | 32.84 |
| E | 7.24 | 7.75 |
| E1 | 7.77 | 7.98 |
| F | 2.54 | |
| L | 3.73 | 4.01 |
| Q | 0.508 | 1.778 |
| S | 1.85 | 1.93 |

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