# HD74AC195

## 4-bit Parallel-Access Shift Register

REJ03D0260–0200Z
(Previous ADE-205-380 (Z))
Rev.2.00
Jul.16.2004

## Description

This shift register features parallel inputs, parallel outputs, J-$\overline{K}$ serial inputs, Shift/Load control input, and a direct overriding clear. This shift register can operate in two modes: Parallel load; Shift from $Q_0$ towards $Q_3$.

Parallel loading is accomplished by applying the four bits of data, and taking the $\overline{PE}$ Input low. The data is loaded into the associated flip-flops and appears at the outputs after the positive transition of the CP input. During parallel loading, serial data flow is inhibited. Serial shifting occurs synchronously when the $\overline{PE}$ input is high. Serial data for this mode is entered at the J-$\overline{K}$ inputs. These inputs allow the first stage to perform as a J-$\overline{K}$ or toggle flip-flop as shown in the function table.

## Features

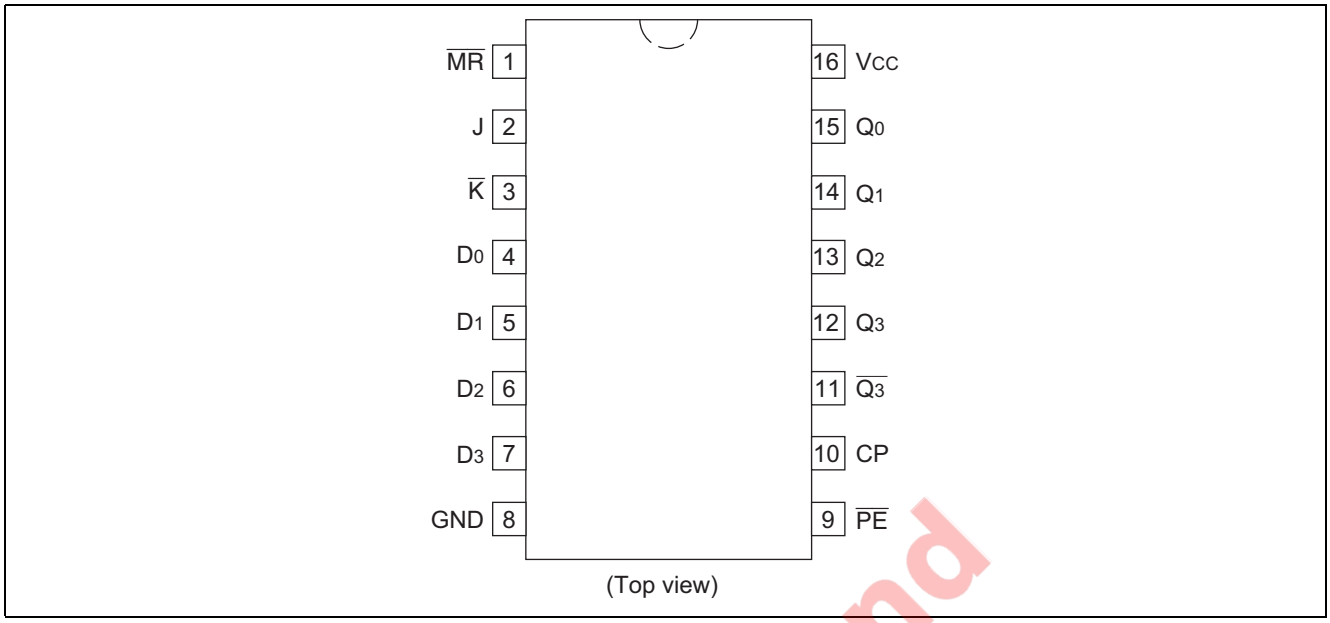
- Shift Right and Parallel Load Capability
- J-$\overline{K}$ (D-Type) Inputs to First Stage
- Complement Output from Last Stage
- Asynchronous Master Reset
- Outputs Source/Sink 24 mA

- Ordering Information

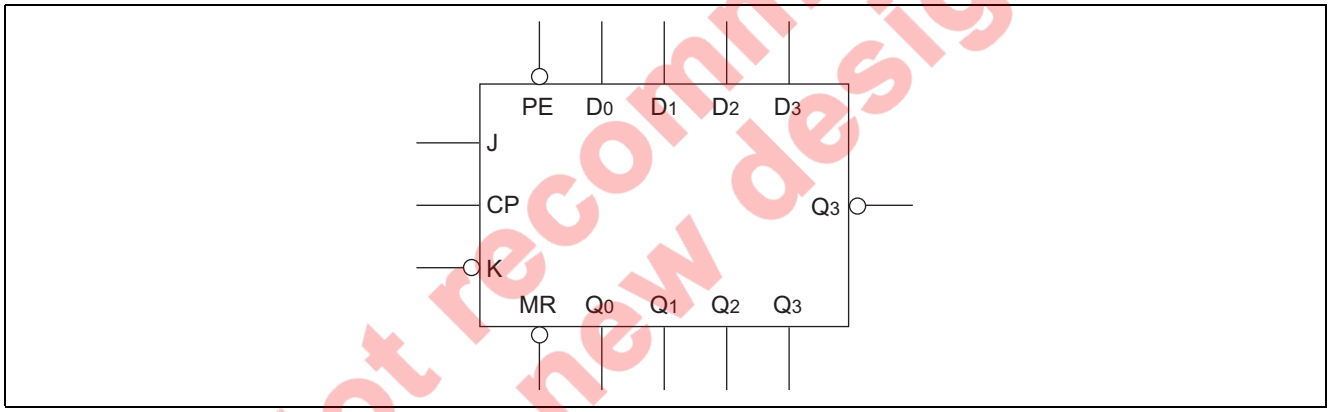
| Part Name | Package Type | Package Code | Package Abbreviation | Taping Abbreviation (Quantity) |
|---|---|---|---|---|
| HD74AC195FPEL | SOP-16 pin (JEITA) | FP-16DAV | FP | EL (2,000 pcs/reel) |
| HD74AC195RPEL | SOP-16 pin (JEDEC) | FP-16DNV | RP | EL (2,500 pcs/reel) |

Notes: 1. Please consult the sales office for the above package availability.
2. The packages with lead-free pins are distinguished from the conventional products by adding V at the end of the package code.

## Pin Arrangement



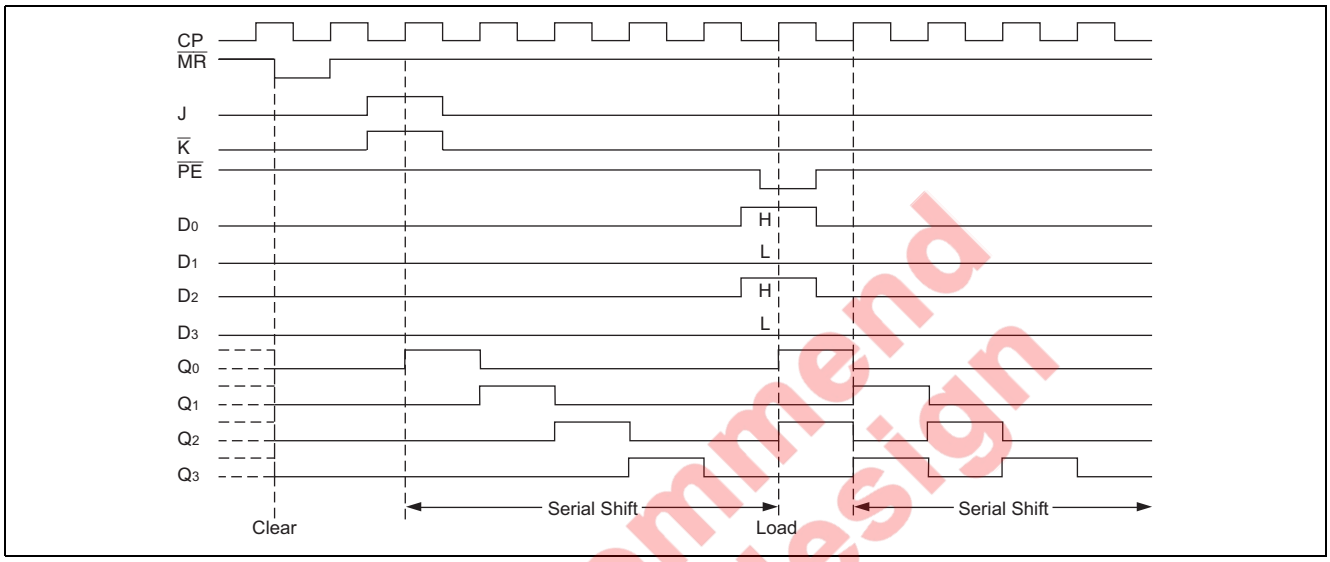

## Logic Symbol



## Pin Names

| | |
|---|---|
| CP | Clock Pulse Input (Active Rising Edge) |
| $D_0$ to $D_3$ | Parallel Data Inputs |
| $\overline{PE}$ | Parallel Enable Input |
| $\overline{MR}$ | Asynchronous Master Reset |
| J, $\overline{K}$ | J-$\overline{K}$ or D Type Serial Inputs |
| $Q_0$ to $Q_3$, $\overline{Q}_3$ | Outputs |

## Timing Diagram






## Mode Select-Function Table

| Operating Modes | Inputs | | | | | | Outputs | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\overline{MR}$ | CP | $\overline{PE}$ | J | $\overline{K}$ | $D_n$ | $Q_0$ | $Q_1$ | $Q_2$ | $Q_3$ | $\overline{Q}_3$ |
| Asynchronous Reset | L | X | X | X | X | X | L | L | L | L | H |
| Shift, Set First Stage | H | ↑ | H | H | H | X | H | $q_0$ | $q_1$ | $q_2$ | $\overline{q}_2$ |
| Shift, Reset First Stage | H | ↑ | H | L | L | X | L | $q_0$ | $q_1$ | $q_2$ | $\overline{q}_2$ |
| Shift, Toggle First Stage | H | ↑ | H | H | L | X | $\overline{q}_0$ | $q_0$ | $q_1$ | $q_2$ | $\overline{q}_2$ |
| Shift, Retain First Stage | H | ↑ | H | L | H | X | $q_0$ | $q_0$ | $q_1$ | $q_2$ | $\overline{q}_2$ |
| Parallel Load | H | ↑ | L | X | X | $d_n$ | $d_0$ | $d_1$ | $d_2$ | $d_3$ | $\overline{d}_3$ |

H : HIGH Voltage Level

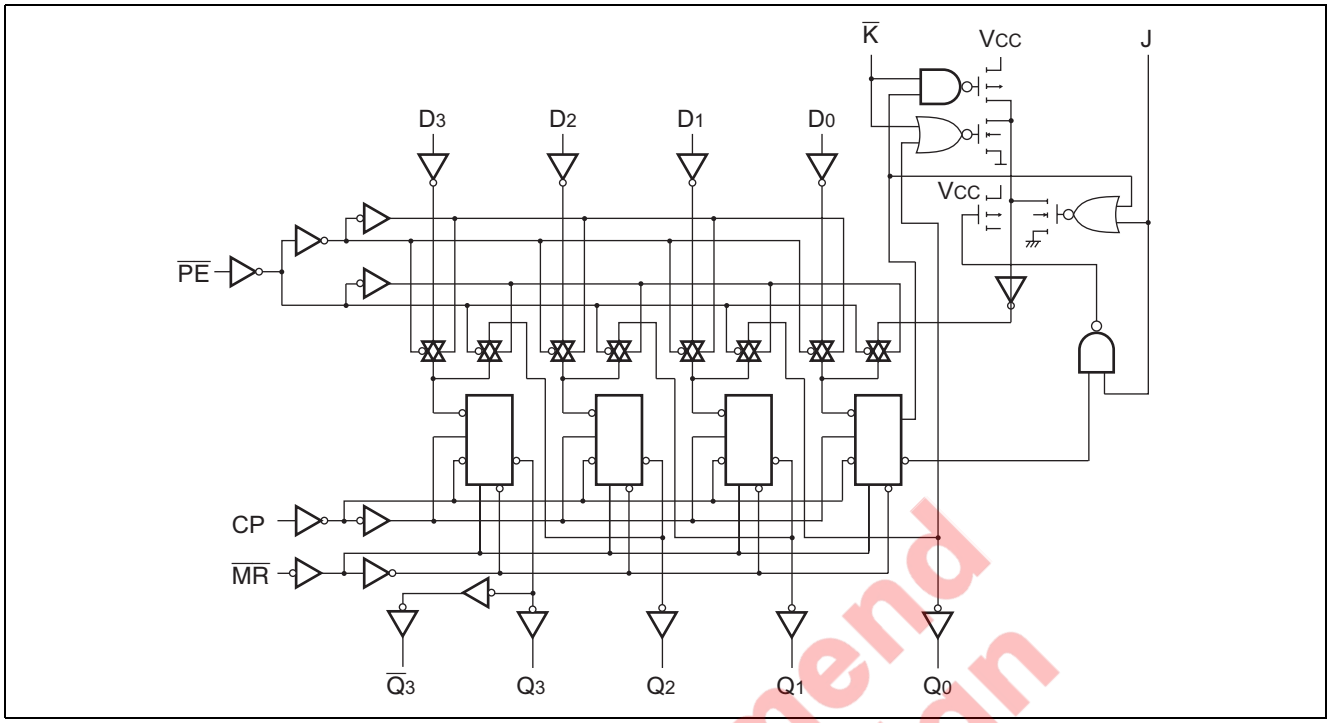
L : LOW Voltage Level

X : Immaterial

Lower case letters indicate the state of the referenced input (or output) one setup time prior to the LOW-to-HIGH transition.

↑ : LOW-to-HIGH clock transition.

## Logic Diagram




## Absolute Maximum Ratings

| Item | Symbol | Ratings | Unit | Condition |
|---|---|---|---|---|
| Supply voltage | $V_{CC}$ | –0.5 to 7 | V | |
| DC input diode current | $I_{IK}$ | –20 | mA | $V_I$ = –0.5V |
| | | 20 | mA | $V_I$ = Vcc+0.5V |
| DC input voltage | $V_I$ | –0.5 to Vcc+0.5 | V | |
| DC output diode current | $I_{OK}$ | –50 | mA | $V_O$ = –0.5V |
| | | 50 | mA | $V_O$ = Vcc+0.5V |
| DC output voltage | $V_O$ | –0.5 to Vcc+0.5 | V | |
| DC output source or sink current | $I_O$ | ±50 | mA | |
| DC $V_{CC}$ or ground current per output pin | $I_{CC}$, $I_{GND}$ | ±50 | mA | |
| Storage temperature | Tstg | –65 to +150 | °C | |



## Recommended Operating Conditions

| Item | Symbol | Ratings | Unit | Condition |
|---|---|---|---|---|
| Supply voltage | $V_{CC}$ | 2 to 6 | V | |
| Input and output voltage | $V_I$, $V_O$ | 0 to $V_{CC}$ | V | |
| Operating temperature | Ta | –40 to +85 | °C | |
| Input rise and fall time (except Schmitt inputs) $V_{IN}$ 30% to 70% $V_{CC}$ | tr, tf | 8 | ns/V | $V_{CC}$ = 3.0V |
| | | | | $V_{CC}$ = 4.5 V |
| | | | | $V_{CC}$ = 5.5 V |

## DC Characteristics

| Item | Sym-bol | Vcc (V) | Ta = 25°C | | | Ta = –40 to +85°C | | Unit | Condition | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | min. | max. | | | |
| Input Voltage | $V_{IH}$ | 3.0 | 2.1 | 1.5 | — | 2.1 | — | V | $V_{OUT}$ = 0.1 V or $V_{CC}$ –0.1 V | |
| | | 4.5 | 3.15 | 2.25 | — | 3.15 | — | | | |
| | | 5.5 | 3.85 | 2.75 | — | 3.85 | — | | | |
| | $V_{IL}$ | 3.0 | — | 1.50 | 0.9 | — | 0.9 | | $V_{OUT}$ = 0.1 V or $V_{CC}$ –0.1 V | |
| | | 4.5 | — | 2.25 | 1.35 | — | 1.35 | | | |
| | | 5.5 | — | 2.75 | 1.65 | — | 1.65 | | | |
| Output voltage | $V_{OH}$ | 3.0 | 2.9 | 2.99 | — | 2.9 | — | V | $V_{IN}$ = $V_{IL}$ or $V_{IH}$<br>$I_{OUT}$ = –50 µA | |
| | | 4.5 | 4.4 | 4.49 | — | 4.4 | — | | | |
| | | 5.5 | 5.4 | 5.49 | — | 5.4 | — | | | |
| | | 3.0 | 2.58 | — | — | 2.48 | — | | $V_{IN}$ = $V_{IL}$ or $V_{IH}$ | $I_{OH}$ = –12 mA |
| | | 4.5 | 3.94 | — | — | 3.80 | — | | | $I_{OH}$ = –24 mA |
| | | 5.5 | 4.94 | — | — | 4.80 | — | | | $I_{OH}$ = –24 mA |
| | $V_{OL}$ | 3.0 | — | 0.002 | 0.1 | — | 0.1 | | $V_{IN}$ = $V_{IL}$ or $V_{IH}$<br>$I_{OUT}$ = 50 µA | |
| | | 4.5 | — | 0.001 | 0.1 | — | 0.1 | | | |
| | | 5.5 | — | 0.001 | 0.1 | — | 0.1 | | | |
| | | 3.0 | — | — | 0.32 | — | 0.37 | | $V_{IN}$ = $V_{IL}$ or $V_{IH}$ | $I_{OL}$ = 12 mA |
| | | 4.5 | — | — | 0.32 | — | 0.37 | | | $I_{OL}$ = 24 mA |
| | | 5.5 | — | — | 0.32 | — | 0.37 | | | $I_{OL}$ = 24 mA |
| Input leakage current | $I_{IN}$ | 5.5 | — | — | ±0.1 | — | ±1.0 | µA | $V_{IN}$ = $V_{CC}$ or GND | |
| Dynamic output current* | $I_{OLD}$ | 5.5 | — | — | — | 86 | — | mA | $V_{OLD}$ = 1.1 V | |
| | $I_{OHD}$ | 5.5 | — | — | — | –75 | — | mA | $V_{OHD}$ = 3.85 V | |
| Quiescent supply current | $I_{CC}$ | 5.5 | — | — | 8.0 | — | 80 | µA | $V_{IN}$ = $V_{CC}$ or ground | |

*Maximum test duration 2.0 ms, one output loaded at a time.

## AC Characteristics

| Item | Symbol | $V_{CC}$ (V)*[1] | Ta = +25°C $C_L$ = 50 pF | | | Ta = –40°C to +85°C $C_L$ = 50 pF | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | |
| Maximum clock frequency | $f_{max}$ | 3.3 | 75 | — | — | 65 | — | MHz |
| | | 5.0 | 100 | — | — | 85 | — | |
| Propagation delay CP to $Q_n$ or $\overline{Q}_3$ | $t_{PLH}$ | 3.3 | 1.0 | 9.0 | 13.0 | 1.0 | 15.0 | ns |
| | | 5.0 | 1.0 | 5.5 | 10.0 | 1.0 | 11.5 | |
| Propagation delay CP to $Q_n$ or $\overline{Q}_2$ | $t_{PHL}$ | 3.3 | 1.0 | 9.0 | 13.0 | 1.0 | 15.0 | ns |
| | | 5.0 | 1.0 | 6.5 | 10.0 | 1.0 | 11.5 | |
| Propagation delay $\overline{MR}$ to $\overline{Q}_2$ | $t_{PLH}$ | 3.3 | 1.0 | 7.5 | 10.5 | 1.0 | 12.0 | ns |
| | | 5.0 | 1.0 | 5.5 | 8.0 | 1.0 | 9.5 | |
| Propagaion delay $\overline{MR}$ to $\overline{Q}_n$ | $t_{PHL}$ | 3.3 | 1.0 | 6.0 | 9.0 | 1.0 | 10.5 | ns |
| | | 5.0 | 1.0 | 5.0 | 7.0 | 1.0 | 8.0 | |

Note: 1. Voltage Range 3.3 is 3.3 V ± 0.3 V
Voltage Range 5.0 is 5.0 V ± 0.5 V

## AC Operating Requirements

| Item | Symbol | $V_{CC}$ (V)*[1] | Ta = +25°C, $C_L$ = 50 pF | | Ta = –40°C to +85°C, $C_L$ = 50 pF | Unit |
|---|---|---|---|---|---|---|
| | | | Typ | Guaranteed Minimum | | |
| Setup time, HIGH or LOW J, $\overline{K}$ or $\overline{D}_n$ to CP | $t_{su}$ | 3.3 | 3.0 | 5.5 | 7.0 | ns |
| | | 5.0 | 2.0 | 4.0 | 5.0 | |
| Hold time, HIGH or LOW J, $\overline{K}$ or $\overline{D}_n$ to CP | $t_h$ | 3.3 | –0.5 | 2.0 | 3.5 | ns |
| | | 5.0 | 0.5 | 1.5 | 2.0 | |
| Setup time, HIGH or LOW $\overline{PE}$ to CP | $t_{su}$ | 3.3 | 3.5 | 5.0 | 7.0 | ns |
| | | 5.0 | 2.5 | 4.0 | 5.0 | |
| Hold time, HIGH or LOW $\overline{PE}$ to CP | $t_h$ | 3.3 | –2.0 | 0.0 | 0.0 | ns |
| | | 5.0 | –1.5 | 0.0 | 0.0 | |
| Recovery time $\overline{MR}$ to CP | $t_{rec}$ | 3.3 | –1.5 | 0.5 | 0.5 | ns |
| | | 5.0 | –1.0 | 0.5 | 0.5 | |
| Pulse width | $t_w$ | 3.3 | –3.0 | 5.5 | 7.0 | ns |
| | | 5.0 | –3.0 | 4.5 | 5.0 | |

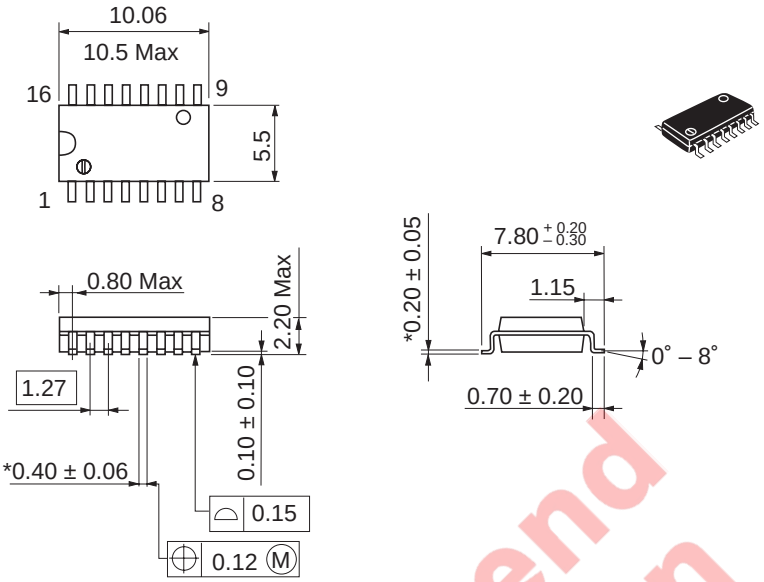
Note: 1. Voltage Range 3.3 is 3.3 V ± 0.3 V
Voltage Range 5.0 is 5.0 V ± 0.5 V

## Capacitance

| Item | Symbol | Typ | Unit | Condition |
|---|---|---|---|---|
| Input capacitance | $C_{IN}$ | 4.5 | pF | $V_{CC}$ = 5.5 V |
| Power dissipation capacitance | $C_{PD}$ | 125 | pF | $V_{CC}$ = 5.0 V |

## Package Dimensions

As of January, 2003
Unit: mm

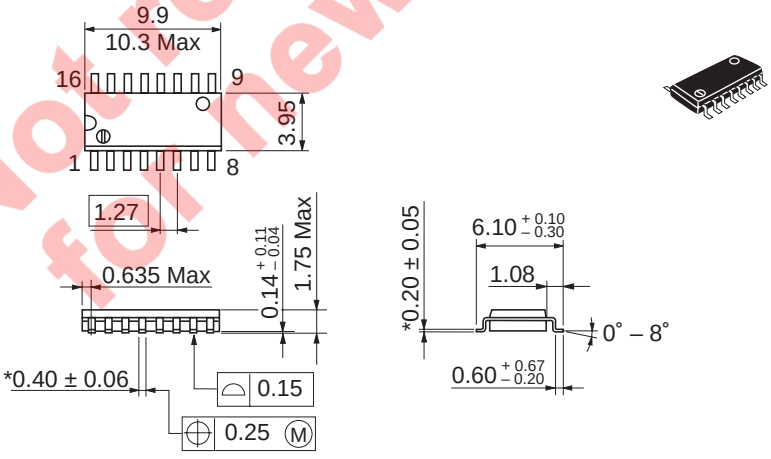



| | |
|---|---|
| Package Code | FP-16DAV |
| JEDEC | — |
| JEITA | Conforms |
| Mass (reference value) | 0.24 g |

*Ni/Pd/Au plating



As of January, 2003
Unit: mm




| | |
|---|---|
| Package Code | FP-16DNV |
| JEDEC | Conforms |
| JEITA | Conforms |
| Mass (reference value) | 0.15 g |

*Ni/Pd/Au plating

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