FAIRCHILD
SEMICONDUCTOR™

November 1988
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# 74AC14 • 74ACT14
# Hex Inverter with Schmitt Trigger Input

## General Description

The 74AC14 and 74ACT14 contain six inverter gates each with a Schmitt trigger input. They are capable of transforming slowly changing input signals into sharply defined, jitter-free output signals. In addition, they have a greater noise margin than conventional inverters.

The 74AC14 and 74ACT14 have hysteresis between the positive-going and negative-going input thresholds (typically 1.0V) which is determined internally by transistor ratios and is essentially insensitive to temperature and supply voltage variations.

## Features

- $I_{CC}$ reduced by 50%
- Outputs source/sink 24 mA
- 74ACT14 has TTL-compatible inputs

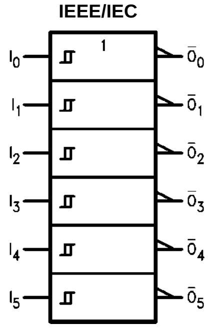
## Ordering Code:

| Order Number | Package Number | Package Description |
|---|---|---|
| 74AC14SC | M14A | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150” Narrow Body |
| 74AC14SJ | M14D | 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide |
| 74AC14MTC | MTC14 | 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MS-153, 4.4mm Wide |
| 74AC14PC | N14A | 14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300” Wide |
| 74ACT14SC | M14A | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150” Narrow Body |
| 74ACT14MTC | MTC14 | 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MS-153, 4.4mm Wide |
| 74ACT14PC | N14A | 14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300” Wide |

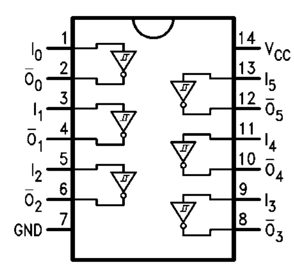
Device also available in Tape and Reel. Specify by appending suffix letter “X” to the ordering code.

## Logic Symbol

IEEE/IEC




## Connection Diagram




## Pin Descriptions

| Pin Names | Description |
|---|---|
| $I_n$ | Inputs |
| $\overline{O}_n$ | Outputs |

## Function Table

| Input | Output |
|---|---|
| A | $\overline{O}$ |
| L | H |
| H | L |

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## Absolute Maximum Ratings(Note 1)

| | |
|---|---|
| Supply Voltage ($V_{CC}$) | −0.5V to +7.0V |
| DC Input Diode Current ($I_{IK}$) | |
| $V_I = -0.5V$ | −20 mA |
| $V_I = V_{CC} + 0.5V$ | +20 mA |
| DC Input Voltage ($V_I$) | −0.5V to $V_{CC}$ + 0.5V |
| DC Output Diode Current ($I_{OK}$) | |
| $V_O = -0.5V$ | −20 mA |
| $V_O = V_{CC} + 0.5V$ | +20 mA |
| DC Output Voltage ($V_O$) | −0.5V to $V_{CC}$ + 0.5V |
| DC Output Source or Sink Current ($I_O$) | ±50 mA |
| DC $V_{CC}$ or Ground Current per Output Pin ($I_{CC}$ or $I_{GND}$) | ±50 mA |
| Storage Temperature ($T_{STG}$) | −65°C to +150°C |
| Junction Temperature ($T_J$) | |
| PDIP | 140°C |

## Recommended Operating Conditions

| | |
|---|---|
| Supply Voltage ($V_{CC}$) | |
| AC | 2.0V to 6.0V |
| ACT | 4.5V to 5.5V |
| Input Voltage ($V_I$) | 0V to $V_{CC}$ |
| Output Voltage ($V_O$) | 0V to $V_{CC}$ |
| Operating Temperature ($T_A$) | −40°C to +85°C |

**Note 1:** Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. Fairchild does not recommend operation of FACT™ circuits outside databook specifications.

## DC Electrical Characteristics for AC

| Symbol | Parameter | $V_{CC}$ | $T_A = +25°C$ | | $T_A = -40°C$ to $+85°C$ | Units | Conditions |
|---|---|---|---|---|---|---|---|
| | | (V) | Typ | Guaranteed Limits | | | |
| $V_{OH}$ | Minimum HIGH Level Output Voltage | 3.0 | 2.99 | 2.9 | 2.9 | | |
| | | 4.5 | 4.49 | 4.4 | 4.4 | V | $I_{OUT} = -50\ \mu A$ |
| | | 5.5 | 5.49 | 5.4 | 5.4 | | |
| | | 3.0 | | 2.56 | 2.46 | | $I_{OH} = 12$ |
| | | 4.5 | | 3.86 | 3.76 | V | $I_{OH} = 24$ mA |
| | | 5.5 | | 4.86 | 4.76 | | $I_{OH} = 24$ mA (Note 2) |
| $V_{OL}$ | Maximum LOW Level Output Voltage | 3.0 | 0.002 | 0.1 | 0.1 | | |
| | | 4.5 | 0.001 | 0.1 | 0.1 | V | $I_{OUT} = 50\ \mu A$ |
| | | 5.5 | 0.001 | 0.1 | 0.1 | | |
| | | 3.0 | | 0.36 | 0.44 | | $I_{OL} = 12$ |
| | | 4.5 | | 0.36 | 0.44 | V | $I_{OL}$ 24 mA |
| | | 5.5 | | 0.36 | 0.44 | | $I_{OL} = 24$ mA (Note 2) |
| $I_{IN}$ (Note 4) | Maximum Input Leakage Current | 5.5 | | ±0.1 | ±1.0 | µA | $V_I = V_{CC}$, GND |
| $V_{t+}$ | Maximum Positive Threshold | 3.0 | | 2.2 | 2.2 | | |
| | | 4.5 | | 3.2 | 3.2 | V | $T_A$ = Worst Case |
| | | 5.5 | | 3.9 | 3.9 | | |
| $V_{t-}$ | Minimum Negative Threshold | 3.0 | | 0.5 | 0.5 | | |
| | | 4.5 | | 0.9 | 0.9 | V | $T_A$ = Worst Case |
| | | 5.5 | | 1.1 | 1.1 | | |
| $V_{H(MAX)}$ | Maximum Hysteresis | 3.0 | | 1.2 | 1.2 | | |
| | | 4.5 | | 1.4 | 1.4 | V | $T_A$ = Worst Case |
| | | 5.5 | | 1.6 | 1.6 | | |
| $V_{H(MIN)}$ | Minimum Hysteresis | 3.0 | | 0.3 | 0.3 | | |
| | | 4.5 | | 0.4 | 0.4 | V | $T_A$ = Worst Case |
| | | 5.5 | | 0.5 | 0.5 | | |
| $I_{OLD}$ | Minimum Dynamic | 5.5 | | | 75 | mA | $V_{OLD}$ = 1.65V Max |
| $I_{OHD}$ | Output Current (Note 3) | 5.5 | | | −75 | mA | $V_{OHD}$ = 3.85V Min |
| $I_{CC}$ (Note 4) | Maximum Quiescent Supply Current | 5.5 | | 2.0 | 20.0 | µA | $V_{IN} = V_{CC}$ or GND |

**Note 2:** All outputs loaded; thresholds on input associated with output under test.

**Note 3:** Maximum test duration 2.0 ms, one output loaded at a time.

**Note 4:** $I_{IN}$ and $I_{CC}$ @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V $V_{CC}$.

## AC Electrical Characteristics for AC

| Symbol | Parameter | $V_{CC}$ (V) (Note 5) | $T_A = +25°C$, $C_L = 50$ pF Min | $T_A = +25°C$, $C_L = 50$ pF Typ | $T_A = +25°C$, $C_L = 50$ pF Max | $T_A = -40°C$ to $+85°C$, $C_L = 50$ pF Min | $T_A = -40°C$ to $+85°C$, $C_L = 50$ pF Max | Units |
|---|---|---|---|---|---|---|---|---|
| $t_{PLH}$ | Propagation Delay | 3.3 | 1.5 | 9.5 | 13.5 | 1.5 | 15.0 | ns |
| | | 5.0 | 1.5 | 7.0 | 10.0 | 1.5 | 11.0 | |
| $t_{PHL}$ | Propagation Delay | 3.3 | 1.5 | 7.5 | 11.5 | 1.5 | 13.0 | ns |
| | | 5.0 | 1.5 | 6.0 | 8.5 | 1.5 | 9.5 | |

**Note 5:** Voltage Range 3.3 is 3.3V ± 0.3V
Voltage Range 5.0 is 5.0V ± 0.5V

## DC Electrical Characteristics for ACT

| Symbol | Parameter | $V_{CC}$ (V) | $T_A = +25°C$ Typ | $T_A = +25°C$ Guaranteed Limits | $T_A = -40°C$ to $+85°C$ Guaranteed Limits | Units | Conditions |
|---|---|---|---|---|---|---|---|
| $V_{IH}$ | Minimum HIGH Level Input Voltage | 4.5 | 1.5 | 2.0 | 2.0 | V | $V_{OUT} = 0.1V$ |
| | | 5.5 | 1.5 | 2.0 | 2.0 | | or $V_{CC} - 0.1V$ |
| $V_{IL}$ | Maximum LOW Level Output Voltage | 4.5 | 1.5 | 0.8 | 0.8 | V | $V_{OUT} = 0.1V$ |
| | | 5.5 | 1.5 | 0.8 | 0.8 | | or $V_{CC} - 0.1V$ |
| $V_{OH}$ | Minimum HIGH Level Output Voltage | 4.5 | 4.49 | 434 | 4.4 | V | $I_{OUT} = -50\mu A$ |
| | | 5.5 | 5.49 | 5.4 | 5.4 | | |
| | | | | | | V | $V_{IN} = V_{IL}$ or $V_{IH}$ |
| | | 4.5 | | 3.86 | 3.76 | | $I_{OH} = -24$ mA |
| | | 5.5 | | 4.86 | 4.76 | | $I_{OH} = -24$ mA (Note 6) |
| $V_{OL}$ | Maximum LOW Level Output Voltage | 4.5 | 0.001 | 0.1 | 0.1 | V | $I_{OUT} = 50\ \mu A$ |
| | | 5.5 | 0.001 | 0.1 | 0.1 | | |
| | | | | | | V | $V_{IN} = V_{IL}$ or $V_{IH}$ |
| | | 4.5 | | 0.36 | 0.44 | | $I_{OL} = 24$ mA |
| | | 5.5 | | 0.36 | 0.44 | | $I_{OL} = 24$ mA (Note 6) |
| $I_{IN}$ | Maximum Input Leakage Current | 5.5 | | ±0.1 | ±1.0 | µA | $V_I = V_{CC}$, GND |
| $V_{H(MAX)}$ | Maximum Hysteresis | 4.5 | | 1.4 | 1.4 | V | $T_A$ = Worst Case |
| | | 5.5 | | 1.6 | 1.6 | | |
| $V_{H(MIN)}$ | Minimum Hysteresis | 4.5 | | 0.4 | 0.4 | V | $T_A$ = Worst Case |
| | | 5.5 | | 0.5 | 0.5 | | |
| $V_{t+}$ | Maximum Positive Threshold | 4.5 | | 2.0 | 2.0 | V | $T_A$ = Worst Case |
| | | 5.5 | | 2.0 | 2.0 | | |
| $V_{t-}$ | Minimum Negative Threshold | 4.5 | | 0.8 | 0.8 | V | $T_A$ = Worst Case |
| | | 5.5 | | 0.8 | 0.8 | | |
| $I_{CCT}$ | Maximum $I_{CC}$/Input | 5.5 | 0.6 | | 1.5 | mA | $V_I = V_{CC} - 2.1V$ |
| $I_{OLD}$ | Minimum Dynamic | 5.5 | | | 75 | mA | $V_{OLD} = 1.65V$ Max |
| $I_{OHD}$ | Output Current (Note 7) | 5.5 | | | −75 | mA | $V_{OHD} = 3.85V$ Min |
| $I_{CC}$ | Maximum Quiescent Supply Current | 5.5 | | 2.0 | 20.0 | µA | $V_{IN} = V_{CC}$ or GND |

**Note 6:** All outputs loaded; thresholds on input associated with output under test.

**Note 7:** Maximum test duration 2.0 ms, one output loaded at a time.

## AC Electrical Characteristics for ACT

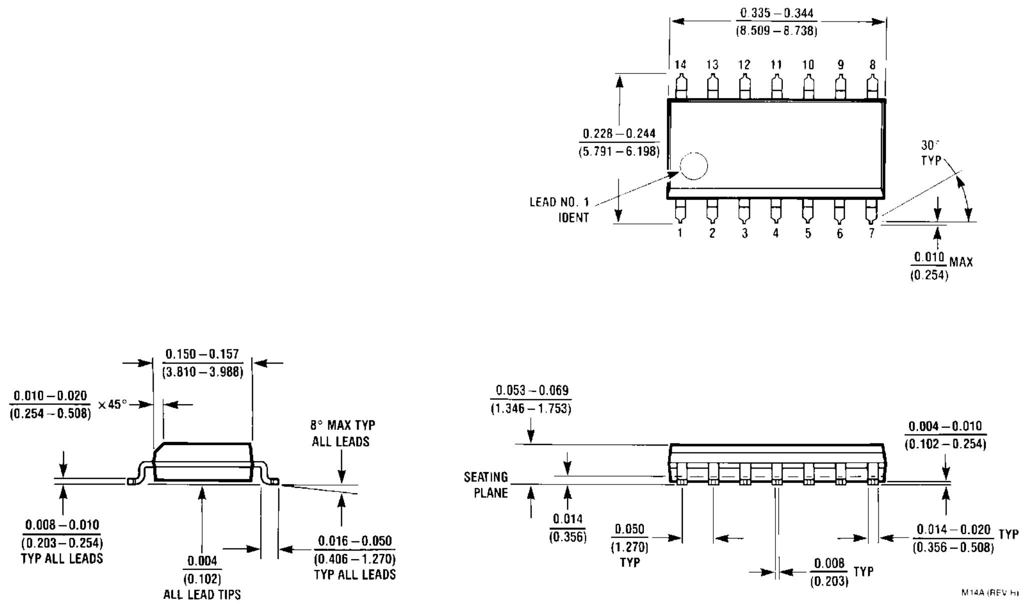
| Symbol | Parameter | $V_{CC}$ (V) (Note 8) | $T_A = +25°C$ $C_L = 50$ pF | | | $T_A = -40°C$ to $+85°C$ $C_L = 50$ pF | | Units |
|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | |
| $t_{PLH}$ | Propagation Delay Data to Output | 5.0 | 3.0 | 8.0 | 10.0 | 3.0 | 11.0 | ns |
| $t_{PHL}$ | Propagation Delay Data to Output | 5.0 | 3.0 | 8.0 | 10.0 | 3.0 | 11.0 | ns |

**Note 8:** Voltage Range 5.0 is 5.0V ± 0.5V

## Capacitance

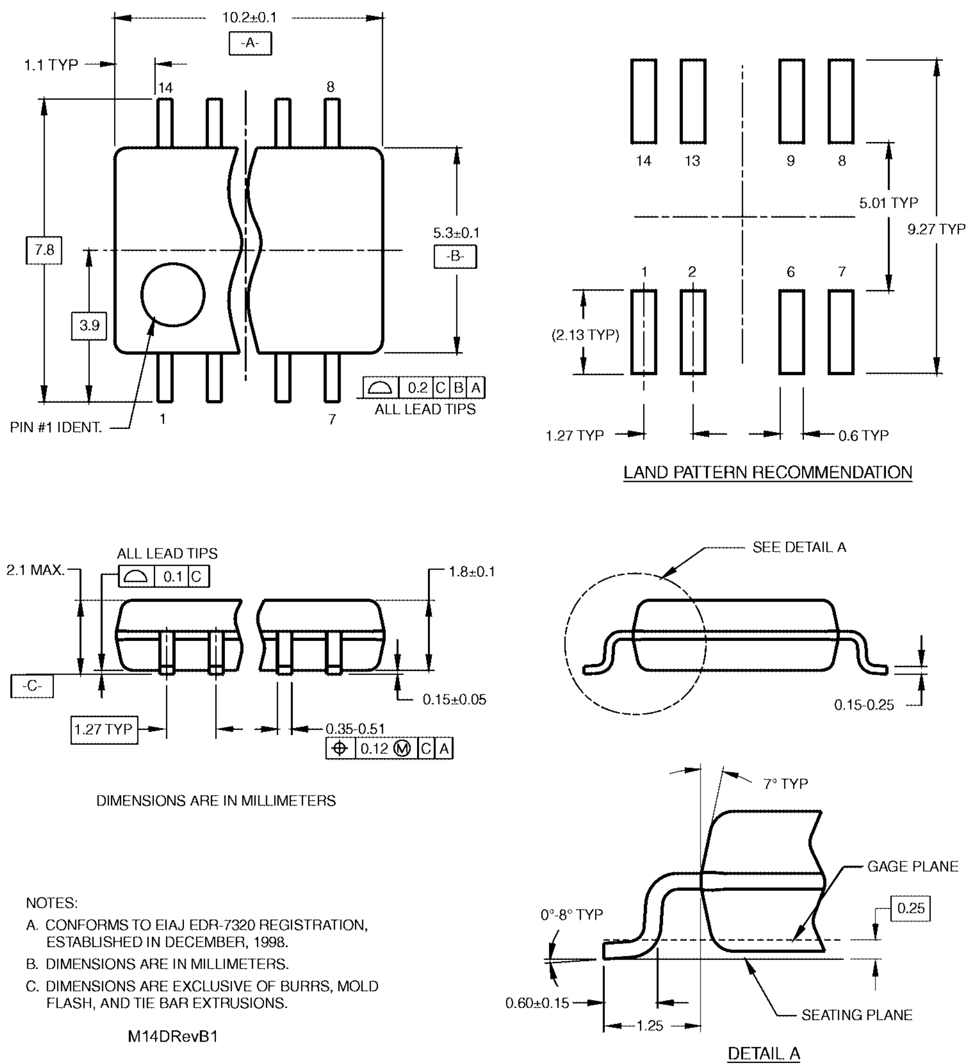
| Symbol | Parameter | Typ | Units | Conditions |
|---|---|---|---|---|
| $C_{IN}$ | Input Capacitance | 4.5 | pF | $V_{CC}$ = OPEN |
| $C_{PD}$ | Power Dissipation Capacitance for AC<br>for ACT | 25.0<br>80 | pF | $V_{CC}$ = 5.0V |

## Physical Dimensions inches (millimeters) unless otherwise noted



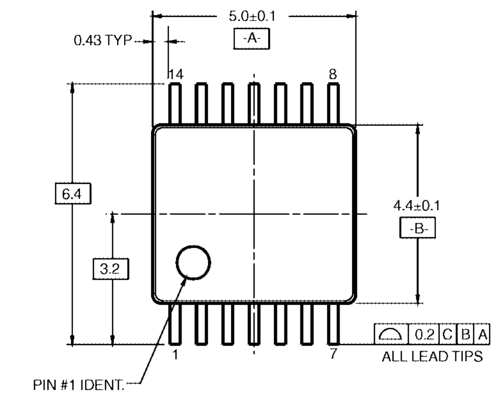

**14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Body**
**Package Number M14A**

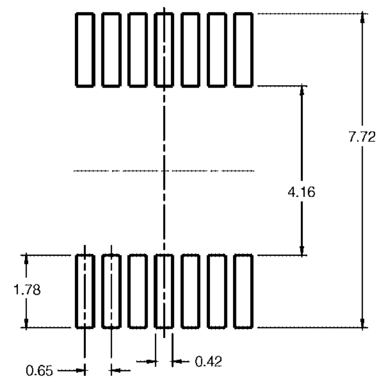
## Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



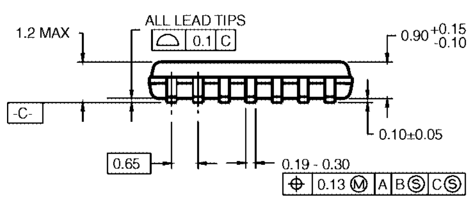

**14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide**
**Package Number M14D**

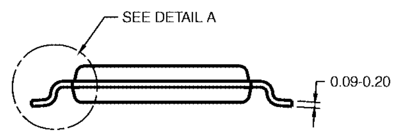
**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)

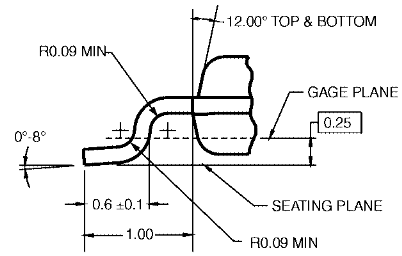



LAND PATTERN RECOMMENDATION




DETAIL A

NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6, DATE 7/93.

B. DIMENSIONS ARE IN MILLIMETERS.

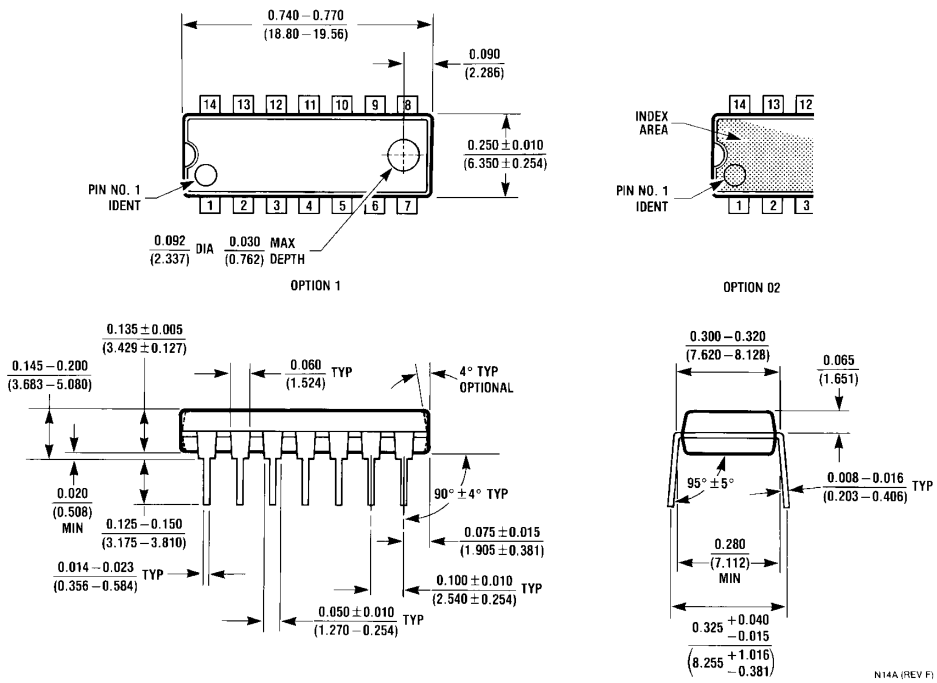
C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

MTC14RevC3

**14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide**
**Package Number MTC14**

## Physical Dimensions inches (millimeters) unless otherwise noted (Continued)




**14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide**
**Package Number N14A**