

74AC646 • 74ACT646

Octal Transceiver/Register with 3-STATE Outputs

General Description

The AC/ACT646 consist of registered bus transceiver circuits, with outputs, D-type flip-flops and control circuitry providing multiplexed transmission of data directly from the input bus or from the internal storage registers. Data on the A or B bus will be loaded into the respective registers on the LOW-to-HIGH transition of the appropriate clock pin (CPAB or CPBA). The four fundamental data handling functions available are illustrated in Figure 1, Figure 2, Figure 3, and Figure 4.

Features

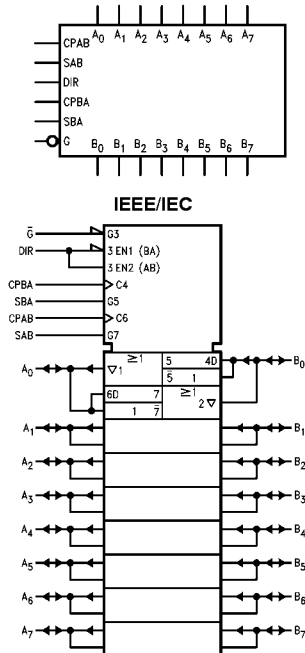
- Independent registers for A and B buses
- Multiplexed real-time and stored data transfers
- 3-STATE outputs
- 300 mil dual-in-line package
- Outputs source/sink 24 mA
- ACT646 has TTL compatible inputs

Ordering Code:

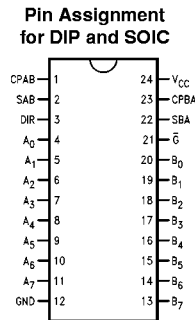
| Order Number | Package Number | Package Description |
|--------------|----------------|---|
| 74AC646SC | M24B | 24-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide Body |
| 74AC646SPC | N24C | 24-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-100, 0.300" Wide |
| 74ACT646SPC | N24C | 24-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-100, 0.300" Wide |

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

Logic Symbols



Connection Diagram



Pin Descriptions

| Pin Names | Description |
|--------------------------------|-------------------------|
| A ₀ -A ₇ | Data Register A Inputs |
| | Data Register A Outputs |
| B ₀ -B ₇ | Data Register B Inputs |
| | Data Register B Outputs |
| CPAB, CPBA | Clock Pulse Inputs |
| SAB, SBA | Transmit/Receive Inputs |
| \bar{G} | Output Enable Input |
| DIR | Direction Control Input |

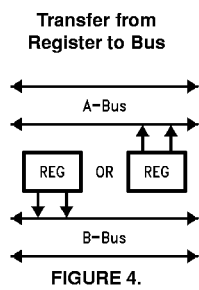
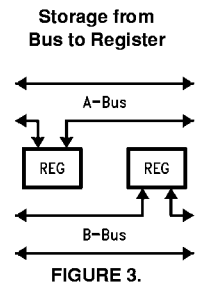
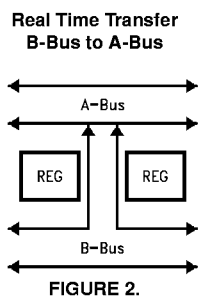
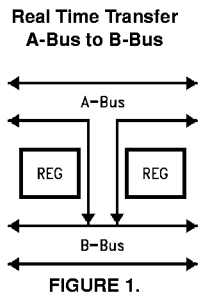
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Function Table

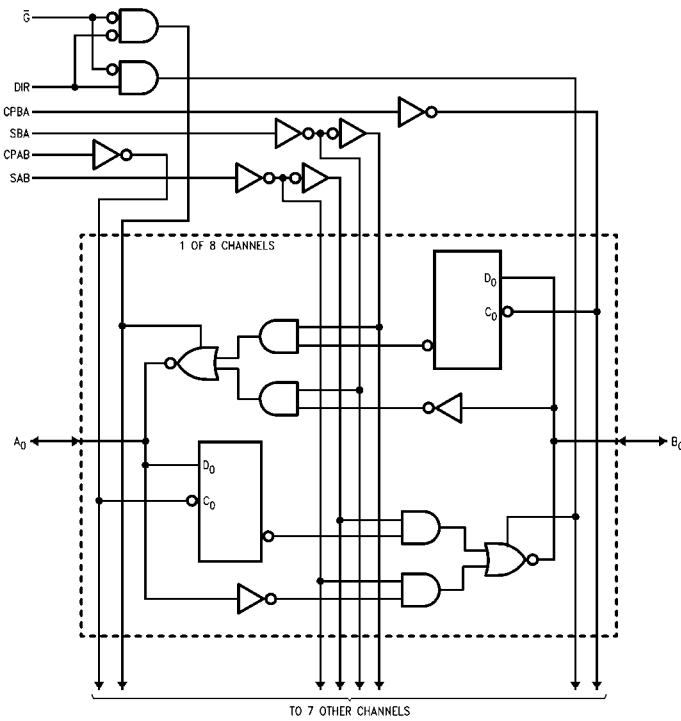
| Inputs | | | | | | Data I/O (Note 1) | | Function |
|----------------|-----|--------|--------|-----|-----|--------------------------------|--------------------------------|--|
| \overline{G} | DIR | CPAB | CPBA | SAB | SBA | A ₀ -A ₇ | B ₀ -B ₇ | |
| H | X | H or L | H or L | X | X | | | Isolation |
| H | X | ↘ | X | X | X | Input | Input | Clock A _n Data into A Register |
| H | X | X | ↘ | X | X | | | Clock B _n Data into B Register |
| L | H | X | X | L | X | Input | Output | A _n to B _n —Real Time (Transparent Mode) |
| L | H | ↘ | X | L | X | | | Clock A _n Data into A Register |
| L | H | H or L | X | H | X | | | A Register to B _n (Stored Mode) |
| L | H | ↘ | X | H | X | | | Clock A _n Data into A Register and Output to B _n |
| L | L | X | X | X | L | Output | Input | B _n to A _n —Real Time (Transparent Mode) |
| L | L | X | ↘ | X | L | | | Clock B _n Data into B Register |
| L | L | X | H or L | X | H | | | B Register to A _n (Stored Mode) |
| L | L | X | ↘ | X | H | | | Clock B _n Data into B Register and Output to A _n |

H = HIGH Voltage Level
 L = LOW Voltage Level
 X = Immaterial
 ↘ = LOW-to-HIGH Transition

Note 1: The data output functions may be enabled or disabled by various signals at the \overline{G} and DIR inputs. Data input functions are always enabled; i.e., data at the bus pins will be stored on every LOW-to-HIGH transition of the appropriate clock inputs.



Logic Diagram



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings (Note 2)

| | |
|--|--------------------------|
| 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 |
| Minimum Input Edge Rate ($\Delta V/\Delta t$) | |
| AC Devices | |
| V_{IN} from 30% to 70% of V_{CC} | |
| V_{CC} @ 3.3V, 4.5V, 5.5V | 125 mV/ns |
| Minimum Input Edge Rate ($\Delta V/\Delta t$) | |
| ACT Devices | |
| V_{IN} from 0.8V to 2.0V | |
| V_{CC} @ 4.5V, 5.5V | 125 mV/ns |

Note 2: Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, with-out 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} (V) | $T_A = +25^\circ\text{C}$ | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | | Units | Conditions |
|-------------------|--------------------------------------|-----------------|---------------------------|-------------------|---|----|---|------------|
| | | | Typ | Guaranteed Limits | | | | |
| V_{IH} | Minimum HIGH Level Input Voltage | 3.0 | 1.5 | 2.1 | 2.1 | V | $V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$ | |
| | | 4.5 | 2.25 | 3.15 | 3.15 | | | |
| | | 5.5 | 2.75 | 3.85 | 3.85 | | | |
| V_{IL} | Maximum LOW Level Input Voltage | 3.0 | 1.5 | 0.9 | 0.9 | V | $V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$ | |
| | | 4.5 | 2.25 | 1.35 | 1.35 | | | |
| | | 5.5 | 2.75 | 1.65 | 1.65 | | | |
| V_{OH} | Minimum HIGH Level Output Voltage | 3.0 | 2.99 | 2.9 | 2.9 | V | $I_{OUT} = -50 \mu A$ | |
| | | 4.5 | 4.49 | 4.4 | 4.4 | | | |
| | | 5.5 | 5.49 | 5.4 | 5.4 | | | |
| | | 3.0 | | 2.56 | 2.46 | V | $V_{IN} = V_{IL}$ or V_{IH} $I_{OH} = -12 \text{ mA}$ $I_{OH} = -24 \text{ mA}$ $I_{OH} = -24 \text{ mA}$ (Note 3) | |
| | | 4.5 | | 3.86 | 3.76 | | | |
| | | 5.5 | | 4.86 | 4.76 | | | |
| V_{OL} | Maximum LOW Level Output Voltage | 3.0 | 0.002 | 0.1 | 0.1 | V | $I_{OUT} = 50 \mu A$ | |
| | | 4.5 | 0.001 | 0.1 | 0.1 | | | |
| | | 5.5 | 0.001 | 0.1 | 0.1 | | | |
| | | 3.0 | | 0.36 | 0.44 | V | $V_{IN} = V_{IL}$ or V_{IH} $I_{OH} = 12 \text{ mA}$ $I_{OL} = 24 \text{ mA}$ $I_{OH} = 24 \text{ mA}$ (Note 3) | |
| | | 4.5 | | 0.36 | 0.44 | | | |
| | | 5.5 | | 0.36 | 0.44 | | | |
| I_{IN} (Note 5) | Maximum Input Leakage Current | 5.5 | | ±0.1 | ±1.0 | μA | $V_I = V_{CC}, \text{GND}$ | |
| I_{OLD} | Minimum Dynamic | 5.5 | | | 75 | mA | $V_{OLD} = 1.65V \text{ Max}$ | |
| I_{OHD} | Output Current (Note 4) | 5.5 | | | -75 | mA | $V_{OHD} = 3.85V \text{ Min}$ | |
| I_{CC} (Note 5) | Maximum Quiescent Supply Current | 5.5 | | 8.0 | 80.0 | μA | $V_{IN} = V_{CC}$ or GND | |
| I_{OZT} | Maximum I/O Leakage Current | 5.5 | | ±0.6 | ±6.0 | μA | V_I (OE) = V_{IL}, V_{IH} $V_I = V_{CC}, \text{GND}$ $V_O = V_{CC}, \text{GND}$ | |

Note 3: All outputs loaded; thresholds on input associated with output under test.

Note 4: Maximum test duration 2.0 ms, one output loaded at a time.

Note 5: I_{IN} and I_{CC} @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V V_{CC} .

DC Electrical Characteristics for ACT

| Symbol | Parameter | V _{CC} (V) | T _A = +25°C | | T _A = -40°C to +85°C | | Units | Conditions |
|------------------|--------------------------------------|------------------------|------------------------|-------------------|---------------------------------|----|---|------------|
| | | | Typ | Guaranteed Limits | | | | |
| V _{IH} | Minimum HIGH Level Input Voltage | 4.5 | 1.5 | 2.0 | 2.0 | V | V _{OUT} = 0.1V or V _{CC} - 0.1V | |
| | | 5.5 | 1.5 | 2.0 | 2.0 | | | |
| V _{IL} | Maximum LOW Level Input Voltage | 4.5 | 1.5 | 0.8 | 0.8 | V | V _{OUT} = 0.1V or V _{CC} - 0.1V | |
| | | 5.5 | 1.5 | 0.8 | 0.8 | | | |
| V _{OH} | Minimum HIGH Level Output Voltage | 4.5 | 4.49 | 4.4 | 4.4 | V | I _{OUT} = -50 μA | |
| | | 5.5 | 5.49 | 5.4 | 5.4 | | | |
| | | 4.5 | | 3.86 | 3.76 | V | V _{IN} = V _{IL} or V _{IH} I _{OH} = -24 mA | |
| V _{OL} | Maximum LOW Level Output Voltage | 4.5 | | 4.86 | 4.76 | V | I _{OH} = -24 mA (Note 6) | |
| | | 5.5 | | | | | | |
| | | 4.5 | 0.001 | 0.1 | 0.1 | V | I _{OUT} = 50 μA | |
| | Maximum Input Leakage Current | 5.5 | | ±0.1 | ±1.0 | μA | V _I = V _{CC} , GND | |
| | | | | | | | | |
| | 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 | | 8.0 | 80.0 | μA | V _{IN} = V _{CC} or GND | |
| I _{OZT} | Maximum I/O Leakage Current | 5.5 | | ±0.6 | ±6.0 | μA | V _I (OE) = V _{IL} , V _{IH} V _I = V _{CC} , GND V _O = V _{CC} , 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 AC

| 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 Clock to Bus | 3.3 | 4.0 | 10.5 | 16.5 | 3.0 | 18.5 | ns |
| | | 5.0 | 2.5 | 7.5 | 12.0 | 2.0 | 13.0 | |
| t _{PHL} | Propagation Delay Clock to Bus | 3.3 | 3.0 | 9.5 | 14.5 | 2.5 | 16.0 | ns |
| | | 5.0 | 2.0 | 6.5 | 10.5 | 1.5 | 11.5 | |
| t _{PLH} | Propagation Delay Bus to Bus | 3.3 | 2.5 | 7.5 | 12.0 | 2.0 | 13.5 | ns |
| | | 5.0 | 1.5 | 5.0 | 8.0 | 1.0 | 9.0 | |
| t _{PHL} | Propagation Delay Bus to Bus | 3.3 | 1.5 | 7.5 | 12.5 | 1.5 | 13.5 | ns |
| | | 5.0 | 1.5 | 5.0 | 9.0 | 1.0 | 9.5 | |
| t _{PLH} | Propagation Delay SBA or SAB to A _n or B _n (w/ A _n or B _n HIGH or LOW) | 3.3 | 2.0 | 8.5 | 13.5 | 1.5 | 15.5 | ns |
| | | 5.0 | 1.5 | 6.0 | 10.0 | 1.5 | 11.0 | |
| t _{PHL} | Propagation Delay SBA or SAB to A _n or B _n (w/ A _n or B _n HIGH or LOW) | 3.3 | 1.5 | 8.5 | 13.5 | 1.5 | 15.0 | ns |
| | | 5.0 | 1.5 | 6.0 | 10.0 | 1.5 | 11.0 | |
| t _{PZH} | Enable Time G̅ to A _n or B _n | 3.3 | 2.5 | 7.0 | 11.5 | 2.0 | 12.5 | ns |
| | | 5.0 | 1.5 | 5.0 | 8.5 | 1.5 | 9.0 | |

AC Electrical Characteristics for AC (Continued)

| 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 _{PZL} | Enable Time G̅ to A _n or B _n | 3.3 | 2.5 | 7.5 | 12.5 | 2.0 | 14.0 | ns |
| | | 5.0 | 1.5 | 5.5 | 9.0 | 1.5 | 10.0 | |
| t _{PHZ} | Disable Time G̅ to A _n or B _n | 3.3 | 3.0 | 8.0 | 12.5 | 2.5 | 13.5 | ns |
| | | 5.0 | 2.0 | 6.5 | 10.0 | 2.0 | 11.0 | |
| t _{PLZ} | Disable Time G̅ to A _n or B _n | 3.3 | 2.0 | 7.5 | 12.0 | 2.0 | 13.5 | ns |
| | | 5.0 | 1.5 | 6.0 | 9.5 | 1.5 | 10.5 | |
| t _{PZH} | Enable Time DIR to A _n or B _n | 3.3 | 2.0 | 6.5 | 11.0 | 1.5 | 12.0 | ns |
| | | 5.0 | 1.5 | 5.0 | 7.5 | 1.0 | 8.5 | |
| t _{PZL} | Enable Time DIR to A _n or B _n | 3.3 | 2.5 | 7.0 | 11.5 | 2.0 | 13.0 | ns |
| | | 5.0 | 1.5 | 5.0 | 8.0 | 1.0 | 9.0 | |
| t _{PHZ} | Disable Time DIR to A _n or B _n | 3.3 | 2.5 | 7.5 | 11.5 | 1.5 | 12.5 | ns |
| | | 5.0 | 1.5 | 5.5 | 9.5 | 1.5 | 10.0 | |
| t _{PLZ} | Disable Time DIR to A _n or B _n | 3.3 | 1.5 | 7.5 | 12.0 | 1.5 | 13.5 | ns |
| | | 5.0 | 1.5 | 5.5 | 9.5 | 1.5 | 10.5 | |

Note 8: Voltage Range 3.3 is 3.3V ±0.3V
Voltage Range 5.0 is 5.0V ±0.5V

AC Operating Requirements for AC

| Symbol | Parameter | V _{CC} (V) (Note 9) | T _A = +25°C C _L = 50 pF | | T _A = -40°C to +85°C C _L = 50 pF | | Units |
|----------------|---|------------------------------------|--|--------------------|---|--|-------|
| | | | Typ | Guaranteed Minimum | | | |
| t _S | Setup Time, HIGH or LOW Bus to Clock | 3.3 | 2.0 | 5.0 | 5.5 | | ns |
| | | 5.0 | 1.5 | 4.0 | 4.5 | | |
| t _H | Hold Time, HIGH or LOW Bus to Clock | 3.3 | -1.5 | 0 | 0 | | ns |
| | | 5.0 | -0.5 | 0.5 | 1.0 | | |
| t _W | Clock Pulse Width HIGH or LOW | 3.3 | 2.0 | 3.5 | 4.5 | | ns |
| | | 5.0 | 2.0 | 3.5 | 3.5 | | |

Note 9: Voltage Range 3.3 is 3.3V ±0.3V
Voltage Range 5.0 is 5.0V ±0.5V

| AC Electrical Characteristics for ACT | | | | | | | | |
|---|--|-------------------------------------|------------------------|------|------|---------------------------------|------|-------|
| Symbol | Parameter | V _{CC} (V) (Note 10) | T _A = +25°C | | | T _A = -40°C to +85°C | | Units |
| | | | C _L = 50 pF | | | C _L = 50 pF | | |
| | | | Min | Typ | Max | Min | Max | |
| t _{PLH} | Propagation Delay Clock to Bus | 5.0 | 3.5 | 12.0 | 14.5 | 3.0 | 16.0 | ns |
| t _{PHL} | Propagation Delay Clock to Bus | 5.0 | 4.0 | 12.0 | 14.5 | 3.5 | 16.0 | ns |
| t _{PLH} | Propagation Delay Bus to Bus | 5.0 | 3.0 | 8.5 | 10.5 | 2.5 | 11.5 | ns |
| t _{PHL} | Propagation Delay Bus to Bus | 5.0 | 2.5 | 8.5 | 10.5 | 2.0 | 11.5 | ns |
| t _{PLH} | Propagation Delay SBA or SAB to A _n to B _n (w/A _n or B _n HIGH or LOW) | 5.0 | 3.0 | 9.5 | 11.5 | 2.5 | 12.5 | ns |
| t _{PHL} | Propagation Delay SBA or SAB to A _n to B _n (w/A _n or B _n HIGH or LOW) | 5.0 | 3.0 | 9.5 | 11.5 | 2.5 | 12.5 | ns |
| t _{PZH} | Enable Time \overline{G} to A _n or B _n | 5.0 | 2.0 | 9.0 | 11.0 | 1.5 | 12.0 | ns |
| t _{PZL} | Enable Time \overline{G} to A _n or B _n | 5.0 | 3.5 | 9.0 | 11.0 | 3.0 | 12.0 | ns |
| t _{PHZ} | Disable Time \overline{G} to A _n or B _n | 5.0 | 5.0 | 10.5 | 13.0 | 4.5 | 14.5 | ns |
| t _{PLZ} | Disable Time \overline{G} to A _n or B _n | 5.0 | 3.5 | 10.0 | 12.5 | 3.0 | 14.0 | ns |
| t _{PZH} | Enable Time DIR to A _n or B _n | 5.0 | 2.0 | 6.5 | 10.5 | 1.5 | 11.5 | ns |
| t _{PZL} | Enable Time DIR to A _n or B _n | 5.0 | 3.5 | 6.5 | 10.5 | 3.0 | 11.5 | ns |
| t _{PHZ} | Disable Time DIR to A _n or B _n | 5.0 | 5.0 | 8.5 | 12.5 | 4.5 | 13.5 | ns |
| t _{PLZ} | Disable Time DIR to A _n or B _n | 5.0 | 3.5 | 8.5 | 12.5 | 3.0 | 13.5 | ns |
| Note 10: Voltage Range 5.0 is 5.0V ±0.5V | | | | | | | | |

AC Operating Requirements for ACT

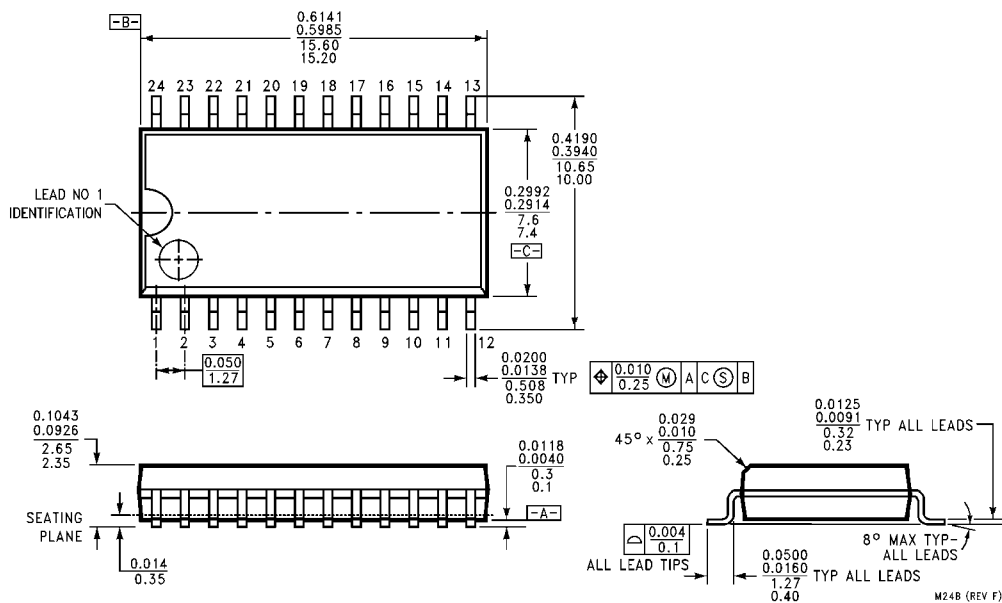
| Symbol | Parameter | V _{CC} (V) (Note 11) | T _A = +25°C C _L = 50 pF | | T _A = -40°C to +85°C C _L = 50 pF | Units |
|----------------|---|-------------------------------------|--|--------------------|---|-------|
| | | | Typ | Guaranteed Minimum | | |
| t _S | Setup Time, HIGH or LOW BUS to Clock | 5.0 | 2.5 | 7.0 | 8.0 | ns |
| t _H | Hold Time, HIGH or LOW Bus to Clock | 5.0 | 0 | 2.5 | 2.5 | ns |
| t _W | Clock Pulse Width HIGH or LOW | 5.0 | 4.5 | 7.0 | 8.0 | ns |

Note 11: Voltage Range 5.0 is 5.0V ±0.5V

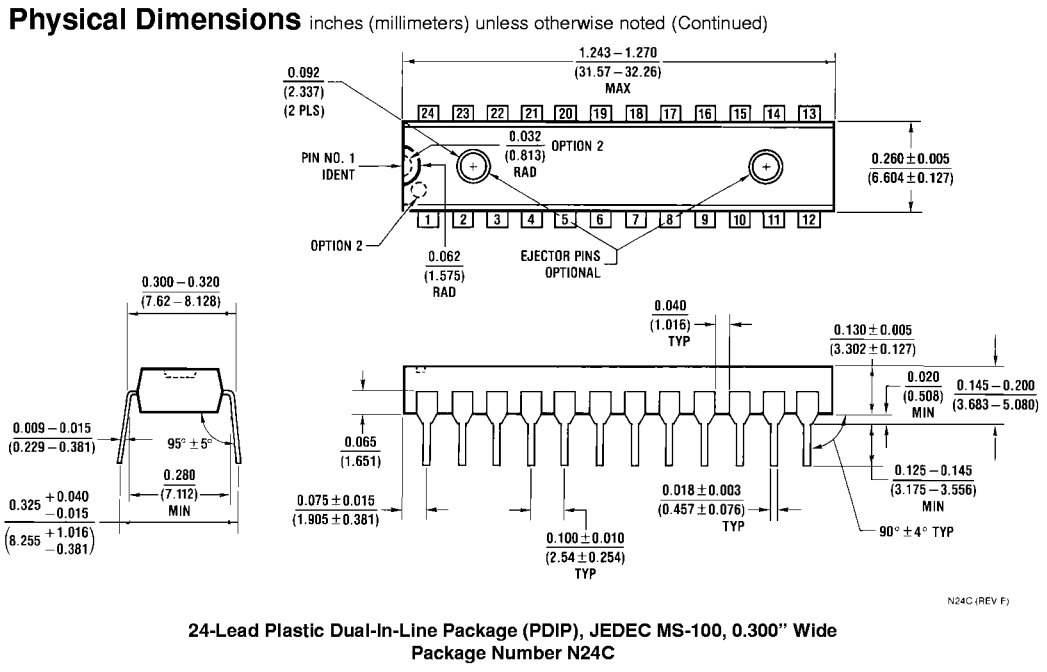
Capacitance

| Symbol | Parameter | Typ | Units | Conditions |
|-----------------|-------------------------------|------|-------|------------------------|
| C _{IN} | Input Capacitance | 4.5 | pF | V _{CC} = OPEN |
| C _{IO} | Input/Output Capacitance | 15.0 | pF | V _{CC} = 5.0V |
| C _{PD} | Power Dissipation Capacitance | 60.0 | pF | V _{CC} = 5.0V |

Physical Dimensions inches (millimeters) unless otherwise noted



**24-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide Body
Package Number M24B**



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