National Semiconductor

September 1995

# CGS74B2525
# 1-to-8 Minimum Skew Clock Driver

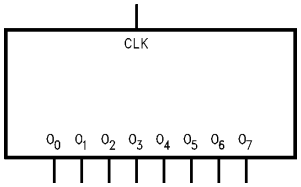
## General Description

This minimum skew clock driver is designed for Clock Generation and Support (CGS) applications operating well above 20 MHz (33 MHz, 50 MHz). The device guarantees minimum output skew across the outputs of a given device and also from device-to-device. Skew parameters are also provided as a means to measure duty cycle requirements as those found in high speed clocking systems. The 'B2525 is a minimum skew clock driver with one input driving eight outputs specifically designed for signal generation and clock distribution applications.

## Features

- Clock Generation and Support (CGS) Device—Ideal for high frequency signal generation or clock distribution applications
- CGS74B version features National's Advanced Bipolar FAST® LSI process
- 1-to-8 low skew clock distribution
- 600 ps pin-to-pin output skew
- Specifications for device-to-device variation of propagation delay
- Specification for transition skew to meet duty cycle requirements
- Center pin $V_{CC}$ and GND configuration to minimize high speed switching noise
- Current sourcing 48 mA and current sinking of 64 mA
- Low dynamic power consumption above 20 MHz
- Guaranteed 4 kV ESD protection

## Logic Symbol

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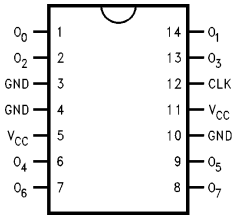
## Connection Diagram

**Pin Assignment for DIP and SOIC**

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RRD-B30M115/Printed in U. S. A.

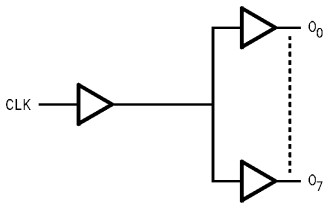
## Functional Description

**Pin Description**

| Pin Names | Description |
|---|---|
| CLK | Clock Input |
| $O_0$–$O_7$ | Outputs |

## Truth Table

| Inputs | Outputs |
|---|---|
| **CLK** | **$O_0$–$O_7$** |
| L | L |
| H | H |

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## Absolute Maximum Ratings (Note 1)

**If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.**

| | | |
|---|---|---|
| Supply Voltage ($V_{CC}$) | | 7.0V |
| Input Voltage ($V_I$) | | 7.0V |
| Operating Free Air Temperature | | 0°C to +70°C |
| Storage Temperature Range | | −65°C to +150°C |
| Junction Temperature ($\theta_{JA}$) | | |
| Plastic (N) Package | 104 | °C/W |
| JEDEC SOIC (M) Package | 120 | °C/W |

## Recommended Operating Conditions

| | |
|---|---|
| Supply Voltage ($V_{CC}$) | 4.5V to 5.5V |
| Input Rise and Fall Times (0.8V to 2.0V) | 9.6 ns max |
| Free Air Operating Temperature ($T_A$) | 0°C to +70°C |

**Note 1:** The Absolute Maximum Ratings are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the DC and AC Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The Recommended Operating Conditions will define the conditions for actual device operation.

## DC Electrical Characteristics

over recommended operating conditions unless specified otherwise. All typical values are measured at $V_{CC} = 5V$, $T_A = 25°C$.

| Symbol | Parameter | Conditions | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| $V_{IK}$ | Input Clamp Voltage | $V_{CC} = 4.5V$, $I_I = -18$ mA | | | | −1.2 | V |
| $V_{IH}$ | Minimum Input High Level Voltage | | | 2.0 | | | V |
| $V_{IL}$ | Maximum Input Low Level Voltage | | | | | 0.8 | V |
| $V_{OH}$ | High Level Output Voltage | $I_{OH} = -3$ mA, $V_{CC} = 4.5V$ | | 2.4 | | | |
| | | $I_{OH} = -48$ mA, $V_{CC} = 4.5V$ | | 2.0 | | | V |
| $V_{OL}$ | Low Level Output Voltage | $V_{CC} = 4.5V$, $I_{OL} = 64$ mA | | | 0.35 | 0.5 | V |
| $I_I$ | Input Current @ Max Input Voltage | $V_{CC} = 5.5V$, $V_{IH} = 7V$ | | | | 0.1 | mA |
| $I_{IH}$ | High Level Input Current | $V_{CC} = 5.5V$, $V_{IH} = 2.7V$ | | | | 20 | μA |
| $I_{IL}$ | Low Level Input Current | $V_{CC} = 5.5V$, $V_{IH} = 0.4V$ | | | | −0.5 | mA |
| $I_O$ | Output Drive Current | $V_{CC} = 5.5V$, $V_O = 2.25V$ | | −50 | | −150 | mA |
| $I_{CC}$ | Supply Current | $V_{CC} = 5.5V$ | Outputs High | | 8 | 15 | mA |
| | | | Outputs Low | | 32 | 42 | mA |
| $C_{IN}$ | Input Capacitance | $V_{CC} = 5V$ | | | 5 | | pF |

## AC Electrical Characteristics

Over recommended operating conditions unless specified otherwise.

| Symbol | Parameter | CGS74B2525 | | | Units |
|---|---|---|---|---|---|
| | | $V_{CC}$ = 4.5V to 5.5V<br>$R_L$ = 500Ω, $C_L$ = 50 pF | | | |
| | | Min | Typ | Max | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>CLK to $O_n$ | 2<br>2 | 3.0<br>3.0 | 4.8<br>4.8 | ns |

## Extended AC Electrical Characteristics

Over recommended operating conditions unless specified otherwise.

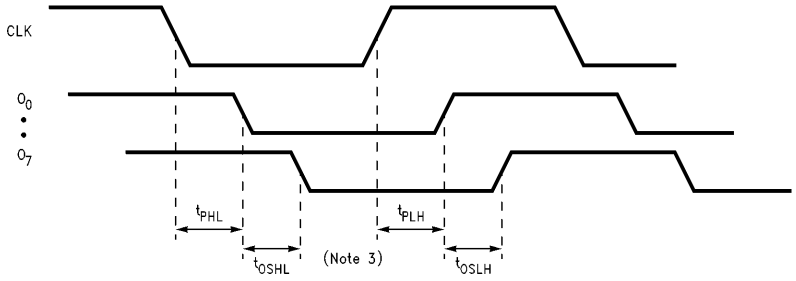
| Symbol | Parameter | CGS74B2525 | | | Units |
|---|---|---|---|---|---|
| | | $V_{CC}$ = 4.5V to 5.5V<br>$R_L$ = 500Ω, $C_L$ = 50 pF,<br>$T_A$ = 0°C to 70°C | | | |
| | | Min | Typ | Max | |
| $f_{max}$ | Maximum Operating Frequency | 50 | | | MHz |
| $t_{OSHL}$ | Maximum Skew Common Edge Output-to-Output Variation (Note 2) | | 150 | 600 | ps |
| $t_{OSLH}$ | Maximum Skew Common Edge Output-to-Output Variation (Note 2) | | 150 | 600 | ps |
| $t_{OST}$ | Maximum Skew Opposite Edge Output-to-Output Variation (Note 2) | | 0.7 | 1.5 | ns |
| $t_{PV}$ | Maximum Skew Part-to-Part Variation Skew (Note 3) | | | 1.75 | ns |
| $t_{PS}$ | Maximum Skew Pin (Signal) Transition Variation (Note 2) | | 0.6 | 1.5 | ns |
| $t_{rise}$,<br>$t_{fall}$ | Maximum Rise/Fall Time (from 0.8V to 2.0V/2.0V to 0.8V) | | | 1.6<br>1.4 | ns<br>ns |

**Note 2:** Output-to-Output Skew is defined as the absolute value of the difference between the actual propagation delay for any outputs within the same packaged device. The specifications apply to any outputs switching in the same direction either HIGH to LOW ($t_{OSHL}$) or LOW to HIGH ($t_{OSLH}$) or in opposite directions both HL and LH ($t_{OST}$). Parameters $t_{OST}$ and $t_{PS}$ guaranteed by design. $t_{OSHL}$ and $t_{OSLH}$ are characterized and guaranteed by design @ 1 MHz.

**Note 3:** Part-to-part skew is defined as the absolute value of the difference between the propagation delay for any outputs from device to device. The parameter is specified for a given set of conditions (i.e., capacitive load, $V_{CC}$, temperature, # of outputs switching, etc.). Parameter guaranteed by design.

**Note 4:** Load capacitance includes the test jig.

## Timing Diagrams

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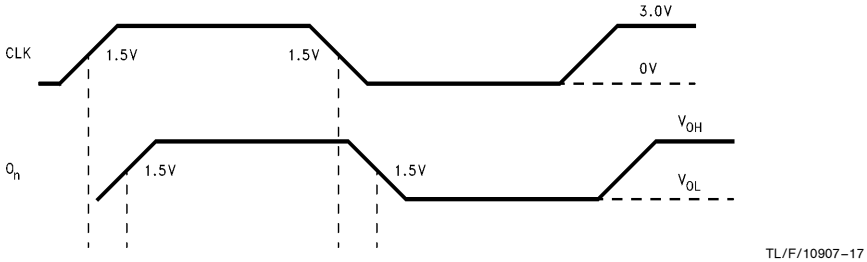


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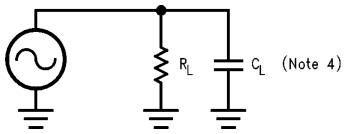
## Test Circuit

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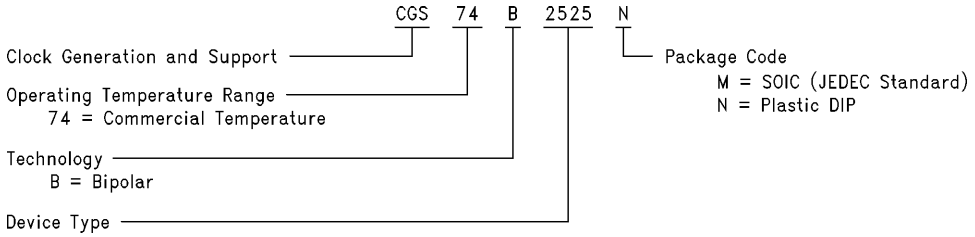
$R_L$ is 500Ω
$C_L$ is 50 pF for all prop delays and skew measurements

## Ordering Information

The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:

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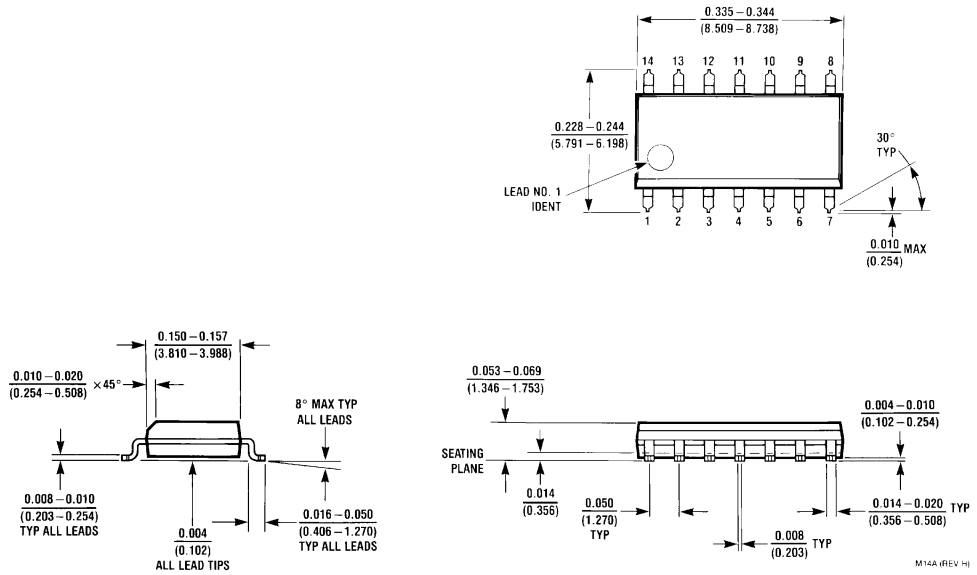
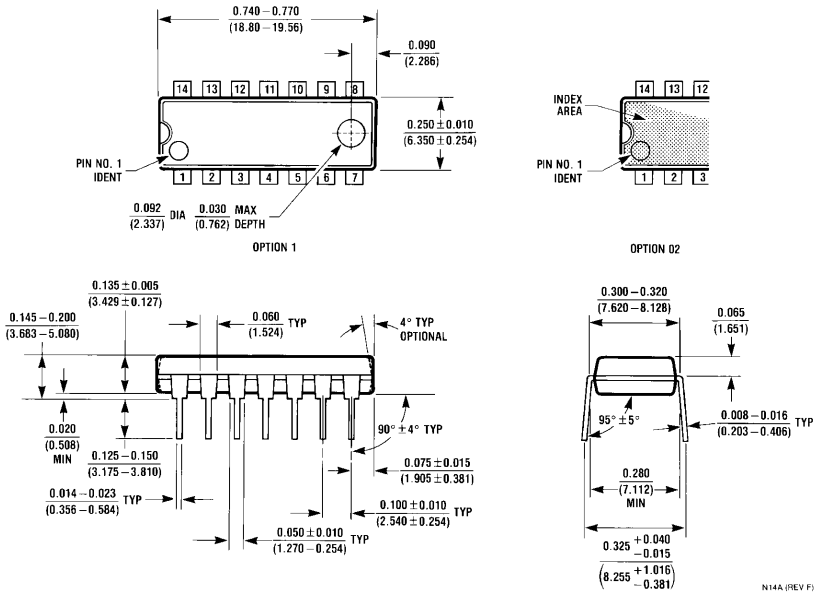
## Physical Dimensions inches (millimeters)




**14-Lead Small Outline Integrated Circuit**
**NS Package Number M14A**

## Physical Dimensions inches (millimeters) (Continued)




**14-Lead Plastic Dual-In-Line Package**
**NS Package Number N14A**

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