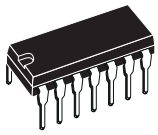
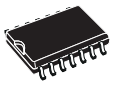
# M74HC132

## QUAD 2-INPUT SCHMITT NAND GATE

- HIGH SPEED:
  $t_{PD}$ = 11ns (TYP.) at $V_{CC}$ = 6V
- LOW POWER DISSIPATION:
  $I_{CC}$ = 1µA(MAX.) at $T_A$=25°C
- HIGH NOISE IMMUNITY:
  $V_H$(TYP.) = 0.9 V AT $V_{CC}$ = 5 V
- SYMMETRICAL OUTPUT IMPEDANCE:
  $|I_{OH}| = I_{OL}$ = 4mA (MIN)
- BALANCED PROPAGATION DELAYS:
  $t_{PLH} \cong t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE:
  $V_{CC}$ (OPR) = 2V to 6V
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 132



DIP



SOP

TSSOP

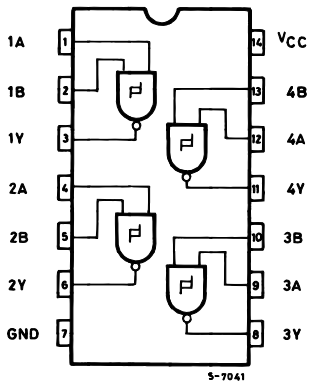
### ORDER CODES

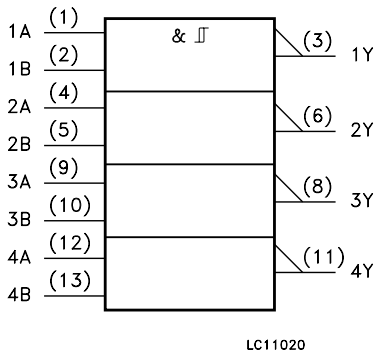
| PACKAGE | TUBE | T & R |
|---|---|---|
| DIP | M74HC132B1R | |
| SOP | M74HC132M1R | M74HC132RM13TR |
| TSSOP | | M74HC132TTR |

### DESCRIPTION

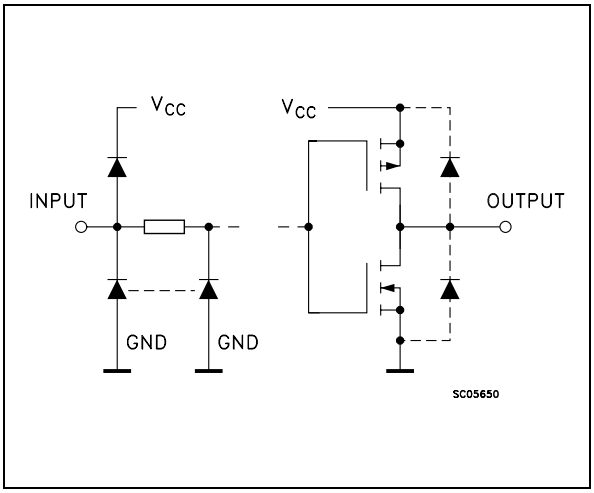
The M74HC132 is an high speed CMOS QUAD 2-INPUT SCHMITT NAND GATE fabricated with silicon gate $C^2$MOS technology.
Pin configuration and function are identical to those of the M74HC00.
The hysteresis characteristics (around 20% $V_{CC}$) of all inputs allow slowly changing input signals to be transformed into sharply defined jitter-free output signals.
All inputs are equipped with protection circuits against static discharge and transient excess voltage.

### PIN CONNECTION AND IEC LOGIC SYMBOLS



## INPUT AND OUTPUT EQUIVALENT CIRCUIT




## PIN DESCRIPTION

| PIN No | SYMBOL | NAME AND FUNCTION |
|---|---|---|
| 1, 4, 9, 12 | 1A to 4A | Data Inputs |
| 2, 5, 10, 13 | 1B to 4B | Data Inputs |
| 3, 6, 8, 11 | 1Y to 4Y | Data Outputs |
| 7 | GND | Ground (0V) |
| 14 | $V_{CC}$ | Positive Supply Voltage |

## TRUTH TABLE

| A | B | Y |
|---|---|---|
| L | L | H |
| L | H | H |
| H | L | H |
| H | H | L |

## ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | | -0.5 to +7 | V |
| $V_I$ | DC Input Voltage | | -0.5 to $V_{CC}$ + 0.5 | V |
| $V_O$ | DC Output Voltage | | -0.5 to $V_{CC}$ + 0.5 | V |
| $I_{IK}$ | DC Input Diode Current | | ± 20 | mA |
| $I_{OK}$ | DC Output Diode Current | | ± 20 | mA |
| $I_O$ | DC Output Current | | ± 25 | mA |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground Current | | ± 50 | mA |
| $P_D$ | Power Dissipation | DIP | 750(*) | mW |
| | | SOP | 500(*) | mW |
| | | TSSOP | 450(*) | mW |
| $T_{stg}$ | Storage Temperature | | -65 to +150 | °C |
| $T_L$ | Lead Temperature (10 sec) | | 300 | °C |

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied
(*) Power difssipation at 65 °C. Derating from 65°C to 125°C: DIP Package -10mW/°C; SO Package -7mW/°C; TSSOP Package -6.1mW/°C

## RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CC}$ | Supply Voltage | 2 to 6 | V |
| $V_I$ | Input Voltage | 0 to $V_{CC}$ | V |
| $V_O$ | Output Voltage | 0 to $V_{CC}$ | V |
| $T_{op}$ | Operating Temperature | -55 to 125 | °C |

## DC SPECIFICATIONS

| Symbol | Parameter | Test Condition | | Value | | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $V_{CC}$ (V) | | $T_A$ = 25°C | | | -40 to 85°C | | -55 to 125°C | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | Max. | |
| $V_P$ | High Level Threshold Voltage | 2.0 | | 1.0 | 1.25 | 1.5 | 1.0 | 1.5 | 1.0 | 1.5 | V |
| | | 4.5 | | 2.3 | 2.7 | 3.15 | 2.3 | 3.15 | 2.3 | 3.15 | |
| | | 6.0 | | 3.0 | 3.5 | 4.2 | 3.0 | 4.2 | 3.0 | 4.2 | |
| $V_N$ | Low Level Threshold Voltage | 2.0 | | 0.3 | 0.65 | 0.9 | 0.3 | 0.9 | 0.3 | 0.9 | V |
| | | 4.5 | | 1.13 | 1.6 | 2.0 | 1.13 | 2.0 | 1.13 | 2.0 | |
| | | 6.0 | | 1.5 | 2.3 | 2.6 | 1.5 | 2.6 | 1.5 | 2.6 | |
| $V_H$ | Hysteresis Voltage | 2.0 | | 0.3 | 0.6 | 1.0 | 0.3 | 1.0 | 0.3 | 1.0 | V |
| | | 4.5 | | 0.6 | 1.1 | 1.4 | 0.6 | 1.4 | 0.6 | 1.4 | |
| | | 6.0 | | 0.8 | 1.2 | 1.4 | 0.8 | 1.7 | 0.8 | 1.7 | |
| $V_{OH}$ | High Level Output Voltage | 2.0 | $I_O$=-20 µA | 1.9 | 2.0 | | 1.9 | | 1.9 | | V |
| | | 4.5 | $I_O$=-20 µA | 4.4 | 4.5 | | 4.4 | | 4.4 | | |
| | | 6.0 | $I_O$=-20 µA | 5.9 | 6.0 | | 5.9 | | 5.9 | | |
| | | 4.5 | $I_O$=-4.0 mA | 4.18 | 4.31 | | 4.13 | | 4.10 | | |
| | | 6.0 | $I_O$=-5.2 mA | 5.68 | 5.8 | | 5.63 | | 5.60 | | |
| $V_{OL}$ | Low Level Output Voltage | 2.0 | $I_O$=-20 µA | | 0.0 | 0.1 | | 0.1 | | 0.1 | V |
| | | 4.5 | $I_O$=-20 µA | | 0.0 | 0.1 | | 0.1 | | 0.1 | |
| | | 6.0 | $I_O$=-20 µA | | 0.0 | 0.1 | | 0.1 | | 0.1 | |
| | | 4.5 | $I_O$=-4.0 mA | | 0.17 | 0.26 | | 0.33 | | 0.40 | |
| | | 6.0 | $I_O$=-5.2 mA | | 0.18 | 0.26 | | 0.33 | | 0.40 | |
| $I_I$ | Input Leakage Current | 6.0 | $V_I$ = $V_{CC}$ or GND | | | ± 0.1 | | ± 1 | | ± 1 | µA |
| $I_{CC}$ | Quiescent Supply Current | 6.0 | $V_I$ = $V_{CC}$ or GND | | | 1 | | 10 | | 20 | µA |

**AC ELECTRICAL CHARACTERISTICS** ($C_L$ = 50 pF, Input $t_r$ = $t_f$ = 6ns)

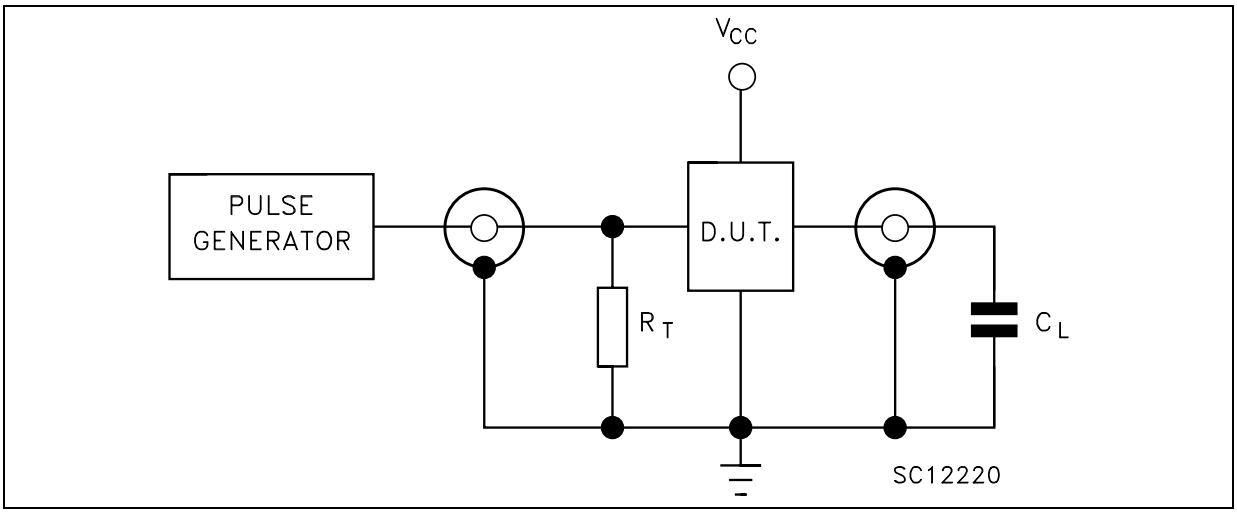
| Symbol | Parameter | Test Condition | | Value | | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $V_{CC}$ (V) | | $T_A$ = 25°C | | | -40 to 85°C | | -55 to 125°C | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | Max. | |
| $t_{TLH}$ $t_{THL}$ | Output Transition Time | 2.0 | | | 30 | 75 | | 95 | | 110 | ns |
| | | 4.5 | | | 8 | 15 | | 19 | | 22 | |
| | | 6.0 | | | 7 | 13 | | 16 | | 19 | |
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay Time | 2.0 | | | 52 | 105 | | 130 | | 160 | ns |
| | | 4.5 | | | 13 | 21 | | 26 | | 32 | |
| | | 6.0 | | | 11 | 18 | | 22 | | 27 | |

## CAPACITIVE CHARACTERISTICS

| Symbol | Parameter | Test Condition | | Value | | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $V_{CC}$ (V) | | $T_A$ = 25°C | | | -40 to 85°C | | -55 to 125°C | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | Max. | |
| $C_{IN}$ | Input Capacitance | 5.0 | | | 5 | 10 | | 10 | | 10 | pF |
| $C_{PD}$ | Power Dissipation Capacitance (note 1) | 5.0 | | | 29 | | | | | | pF |

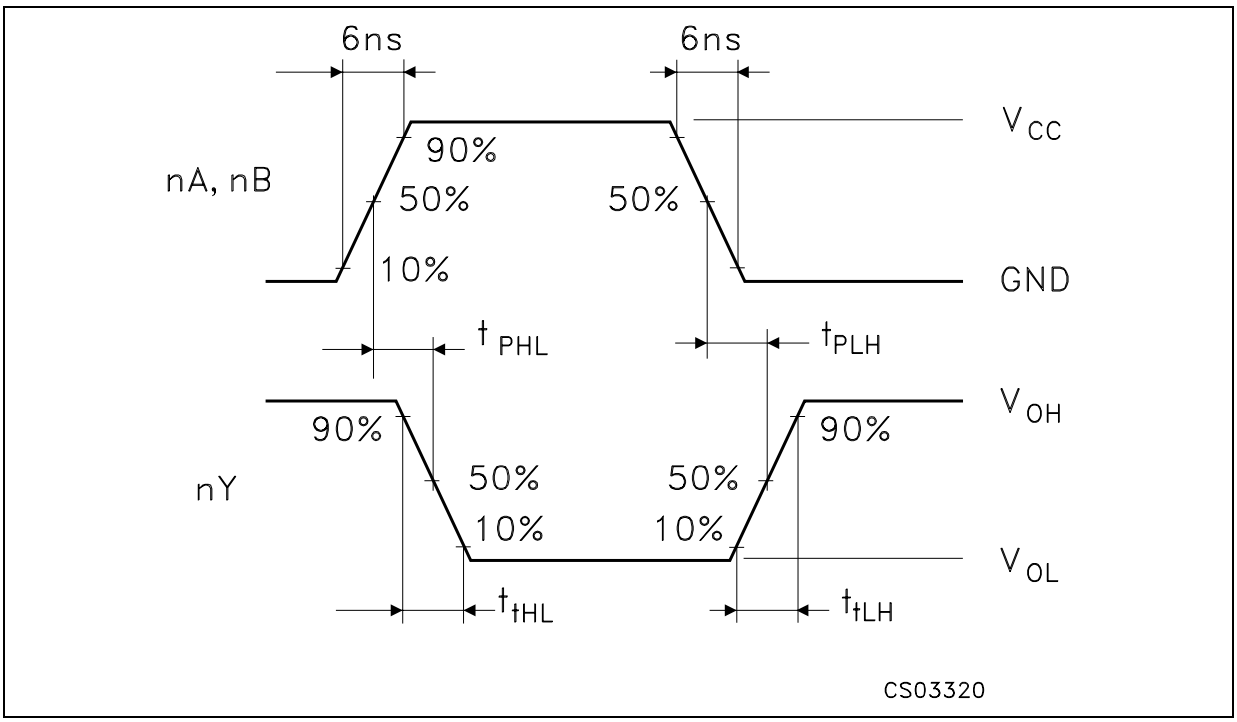
1) $C_{PD}$ is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation. $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/4$ (per gate)

## TEST CIRCUIT



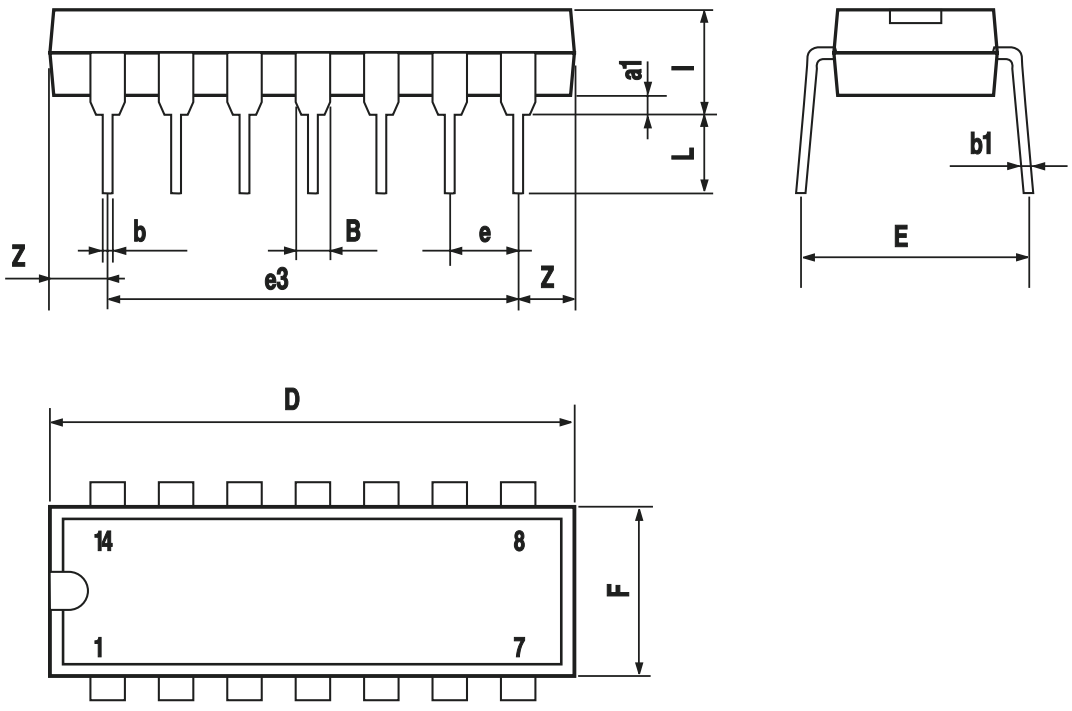

$C_L$ = 50pF or equivalent (includes jig and probe capacitance)
$R_T = Z_{OUT}$ of pulse generator (typically 50Ω)

**WAVEFORM : PROPAGATION DELAY TIMES** (f=1MHz; 50% duty cycle)



## Plastic DIP-14 MECHANICAL DATA

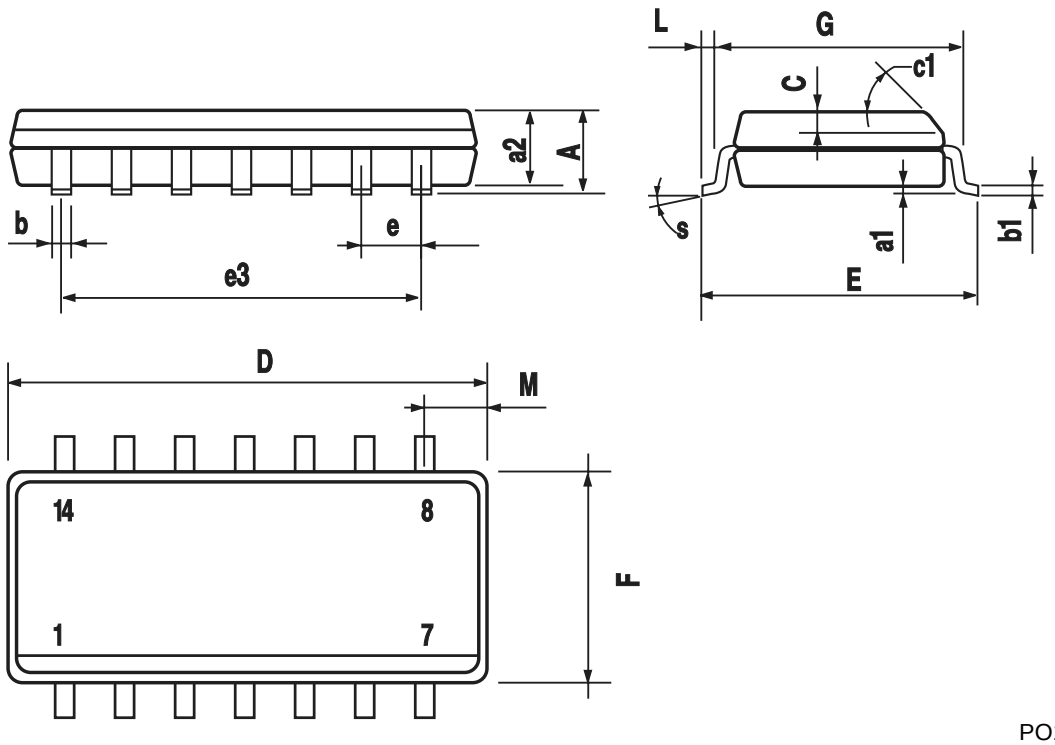
| DIM. | mm. | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| a1 | 0.51 | | | 0.020 | | |
| B | 1.39 | | 1.65 | 0.055 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 0.787 |
| E | | 8.5 | | | 0.335 | |
| e | | 2.54 | | | 0.100 | |
| e3 | | 15.24 | | | 0.600 | |
| F | | | 7.1 | | | 0.280 |
| I | | | 5.1 | | | 0.201 |
| L | | 3.3 | | | 0.130 | |
| Z | 1.27 | | 2.54 | 0.050 | | 0.100 |




P001A

## SO-14 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.75 | | | 0.068 |
| a1 | 0.1 | | 0.2 | 0.003 | | 0.007 |
| a2 | | | 1.65 | | | 0.064 |
| b | 0.35 | | 0.46 | 0.013 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | | 0.5 | | | 0.019 | |
| c1 | 45° (typ.) | | | | | |
| D | 8.55 | | 8.75 | 0.336 | | 0.344 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 7.62 | | | 0.300 | |
| F | 3.8 | | 4.0 | 0.149 | | 0.157 |
| G | 4.6 | | 5.3 | 0.181 | | 0.208 |
| L | 0.5 | | 1.27 | 0.019 | | 0.050 |
| M | | | 0.68 | | | 0.026 |
| S | 8° (max.) | | | | | |




PO13G

## TSSOP14 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.2 | | | 0.047 |
| A1 | 0.05 | | 0.15 | 0.002 | 0.004 | 0.006 |
| A2 | 0.8 | 1 | 1.05 | 0.031 | 0.039 | 0.041 |
| b | 0.19 | | 0.30 | 0.007 | | 0.012 |
| c | 0.09 | | 0.20 | 0.004 | | 0.0089 |
| D | 4.9 | 5 | 5.1 | 0.193 | 0.197 | 0.201 |
| E | 6.2 | 6.4 | 6.6 | 0.244 | 0.252 | 0.260 |
| E1 | 4.3 | 4.4 | 4.48 | 0.169 | 0.173 | 0.176 |
| e | | 0.65 BSC | | | 0.0256 BSC | |
| K | 0° | | 8° | 0° | | 8° |
| L | 0.45 | 0.60 | 0.75 | 0.018 | 0.024 | 0.030 |