

MC14007UB

Dual Complementary Pair Plus Inverter

The MC14007UB multipurpose device consists of three N-Channel and three P-Channel enhancement mode devices packaged to provide access to each device. These versatile parts are useful in inverter circuits, pulse-shapers, linear amplifiers, high input impedance amplifiers, threshold detectors, transmission gating, and functional gating.

Features

- Diode Protection on All Inputs
- Supply Voltage Range = 3.0 Vdc to 18 Vdc
- Capable of Driving Two Low-power TTL Loads or One Low-power Schottky TTL Load Over the Rated Temperature Range
- Pin-for-Pin Replacement for CD4007A or CD4007UB
- This device has 2 outputs without ESD Protection. Antistatic precautions must be taken.
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- This Device is Pb-Free and is RoHS Compliant

MAXIMUM RATINGS (Voltages Referenced to V_{SS})

| Symbol | Parameter | Value | Unit |
|-------------------|---|------------------------|-------------|
| V_{DD} | DC Supply Voltage Range | -0.5 to +18.0 | V |
| V_{in}, V_{out} | Input or Output Voltage Range (DC or Transient) | -0.5 to $V_{DD} + 0.5$ | V |
| I_{in}, I_{out} | Input or Output Current (DC or Transient) per Pin | ± 10 | mA |
| P_D | Power Dissipation, per Package (Note 1) | 500 | mW |
| T_A | Ambient Temperature Range | -55 to +125 | $^{\circ}C$ |
| T_{stg} | Storage Temperature Range | -65 to +150 | $^{\circ}C$ |
| T_L | Lead Temperature (8 second Soldering) | 260 | $^{\circ}C$ |

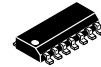
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Temperature Derating: "D/DW" Package: -7.0 mW/ $^{\circ}C$ from 65 $^{\circ}C$ to 125 $^{\circ}C$.



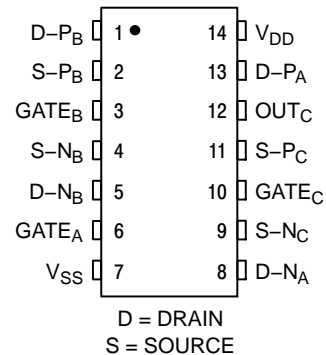
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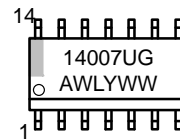


SOIC-14
D SUFFIX
CASE 751A

PIN ASSIGNMENT



MARKING DIAGRAM



A = Assembly Location
WL, L = Wafer Lot
YY, Y = Year
WW, W = Work Week
G = Pb-Free Indicator

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

MC14007UB

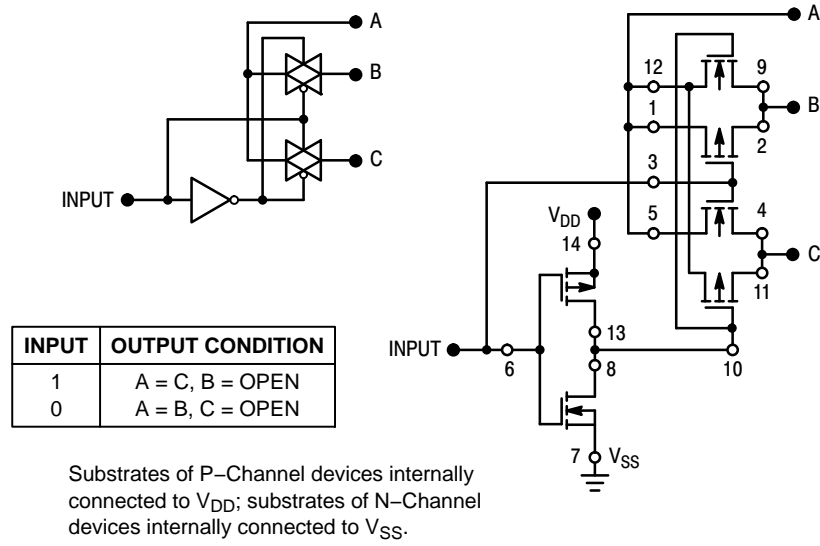


Figure 1. Typical Application: 2-Input Analog Multiplexer

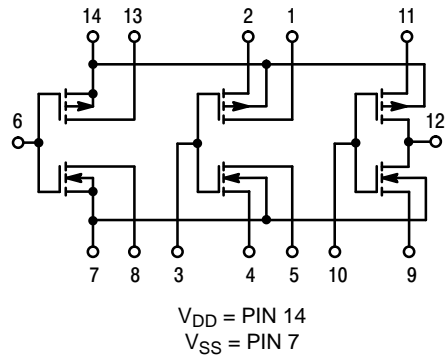


Figure 2. Schematic

MC14007UB

ELECTRICAL CHARACTERISTICS (Voltages Referenced to V_{SS})

| Symbol | Characteristic | V_{DD} Vdc | -55°C | | 25°C | | | 125°C | | Unit |
|----------|---|-----------------|--|-----------|-------|-----------------|-----------|-------|-----------|-----------|
| | | | Min | Max | Min | Typ (Note 2) | Max | Min | Max | |
| V_{OL} | Output Voltage "0" Level $V_{in} = V_{DD}$ or 0 | 5.0 | – | 0.05 | – | 0 | 0.05 | – | 0.05 | Vdc |
| | | 10 | – | 0.05 | – | 0 | 0.05 | – | 0.05 | |
| | | 15 | – | 0.05 | – | 0 | 0.05 | – | 0.05 | |
| V_{OH} | $V_{in} = 0$ or V_{DD} "1" Level | 5.0 | 4.95 | – | 4.95 | 5.0 | – | 4.95 | – | Vdc |
| | | 10 | 9.95 | – | 9.95 | 10 | – | 9.95 | – | |
| | | 15 | 14.95 | – | 14.95 | 15 | – | 14.95 | – | |
| V_{IL} | Input Voltage "0" Level ($V_O = 4.5$ Vdc) ($V_O = 9.0$ Vdc) ($V_O = 13.5$ Vdc) | 5.0 | – | 1.0 | – | 2.25 | 1.0 | – | 1.0 | Vdc |
| | | 10 | – | 2.0 | – | 4.50 | 2.0 | – | 2.0 | |
| | | 15 | – | 2.5 | – | 6.75 | 2.5 | – | 2.5 | |
| V_{IH} | $V_O = 0.5$ Vdc) "1" Level ($V_O = 1.0$ Vdc) ($V_O = 1.5$ Vdc) | 5.0 | 4.0 | – | 4.0 | 2.75 | – | 4.0 | – | Vdc |
| | | 10 | 8.0 | – | 8.0 | 5.50 | – | 8.0 | – | |
| | | 15 | 12.5 | – | 12.5 | 8.25 | – | 12.5 | – | |
| I_{OH} | Output Drive Current Source ($V_{OH} = 2.5$ Vdc) ($V_{OH} = 4.6$ Vdc) ($V_{OH} = 9.5$ Vdc) ($V_{OH} = 13.5$ Vdc) | 5.0 | –3.0 | – | –2.4 | –5.0 | – | –1.7 | – | mAdc |
| | | 5.0 | –0.64 | – | –0.51 | –1.0 | – | –0.36 | – | |
| | | 10 | –1.6 | – | –1.3 | –2.5 | – | –0.9 | – | |
| | | 15 | –4.2 | – | –3.4 | –10 | – | –2.4 | – | |
| I_{OL} | Sink ($V_{OL} = 0.4$ Vdc) ($V_{OL} = 0.5$ Vdc) ($V_{OL} = 1.5$ Vdc) | 5.0 | 0.64 | – | 0.51 | 1.0 | – | 0.36 | – | mAdc |
| | | 10 | 1.6 | – | 1.3 | 2.5 | – | 0.9 | – | |
| | | 15 | 4.2 | – | 3.4 | 10 | – | 2.4 | – | |
| I_{in} | Input Current | 15 | – | ± 0.1 | – | ± 0.00001 | ± 0.1 | – | ± 1.0 | μ Adc |
| C_{in} | Input Capacitance ($V_{in} = 0$) | – | – | – | – | 5.0 | 7.5 | – | – | pF |
| I_{DD} | Quiescent Current (Per Package) | 5.0 | – | 0.25 | – | 0.0005 | 0.25 | – | 7.5 | μ Adc |
| | | 10 | – | 0.5 | – | 0.0010 | 0.5 | – | 15 | |
| | | 15 | – | 1.0 | – | 0.0015 | 1.0 | – | 30 | |
| I_T | Total Supply Current (Notes 3 and 4) (Dynamic plus Quiescent, Per Gate) ($C_L = 50$ pF) | 5.0 | $I_T = (0.7 \mu\text{A/kHz}) f + I_{DD}/6$ | | | | | | | μ Adc |
| 10 | $I_T = (1.4 \mu\text{A/kHz}) f + I_{DD}/6$ | | | | | | | | | |
| 15 | $I_T = (2.2 \mu\text{A/kHz}) f + I_{DD}/6$ | | | | | | | | | |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.

3. The formulas given are for the typical characteristics only at 25°C.

4. To calculate total supply current at loads other than 50 pF: $I_T(C_L) = I_T(50 \text{ pF}) + (C_L - 50) \text{ Vfk}$

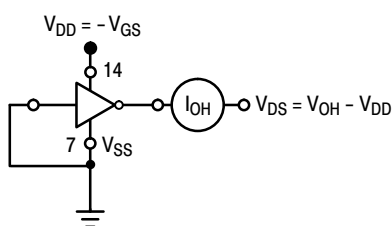
where: I_T is in μA (per package), C_L in pF, $V = (V_{DD} - V_{SS})$ in volts, f in kHz is input frequency, and $k = 0.003$.

MC14007UB

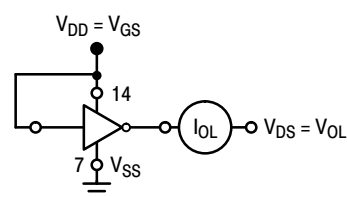
SWITCHING CHARACTERISTICS (Note 5) ($C_L = 50 \text{ pF}$, $T_A = 25^\circ\text{C}$)

| Symbol | Characteristic | V_{DD} Vdc | Min | Typ (Note 6) | Max | Unit |
|-----------|---|-----------------|-----|-----------------|-----|------|
| t_{TLH} | Output Rise Time $t_{TLH} = (1.2 \text{ ns/pF}) C_L + 30 \text{ ns}$ $t_{TLH} = (0.5 \text{ ns/pF}) C_L + 20 \text{ ns}$ $t_{TLH} = (0.4 \text{ ns/pF}) C_L + 15 \text{ ns}$ | 5.0 | - | 90 | 180 | ns |
| | | 10 | - | 45 | 90 | |
| | | 15 | - | 35 | 70 | |
| t_{THL} | Output Fall Time $t_{THL} = (1.2 \text{ ns/pF}) C_L + 15 \text{ ns}$ $t_{THL} = (0.5 \text{ ns/pF}) C_L + 15 \text{ ns}$ $t_{THL} = (0.4 \text{ ns/pF}) C_L + 10 \text{ ns}$ | 5.0 | - | 75 | 150 | ns |
| | | 10 | - | 40 | 80 | |
| | | 15 | - | 30 | 60 | |
| t_{PLH} | Turn-Off Delay Time $t_{PLH} = (1.5 \text{ ns/pF}) C_L + 35 \text{ ns}$ $t_{PLH} = (0.2 \text{ ns/pF}) C_L + 20 \text{ ns}$ $t_{PLH} = (0.15 \text{ ns/pF}) C_L + 17.5 \text{ ns}$ | 5.0 | - | 60 | 125 | ns |
| | | 10 | - | 30 | 75 | |
| | | 15 | - | 25 | 55 | |
| t_{PHL} | Turn-On Delay Time $t_{PHL} = (1.0 \text{ ns/pF}) C_L + 10 \text{ ns}$ $t_{PHL} = (0.3 \text{ ns/pF}) C_L + 15 \text{ ns}$ $t_{PHL} = (0.2 \text{ ns/pF}) C_L + 15 \text{ ns}$ | 5.0 | - | 60 | 125 | ns |
| | | 10 | - | 30 | 75 | |
| | | 15 | - | 25 | 55 | |

5. The formulas given are for the typical characteristics only. Switching specifications are for device connected as an inverter.
6. Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.



All unused inputs connected to ground.



All unused inputs connected to ground.

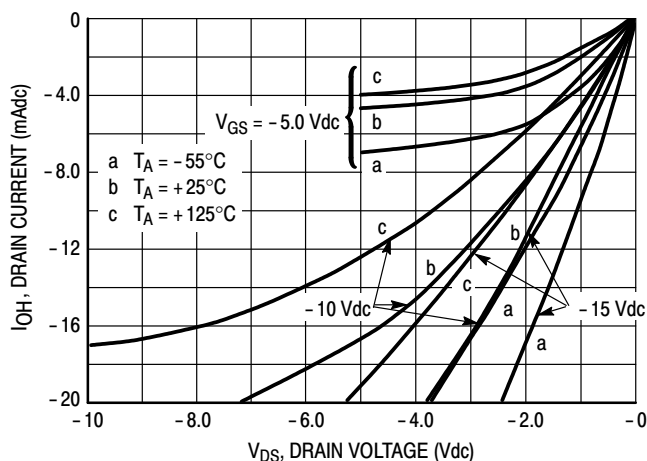


Figure 3. Typical Output Source Characteristics

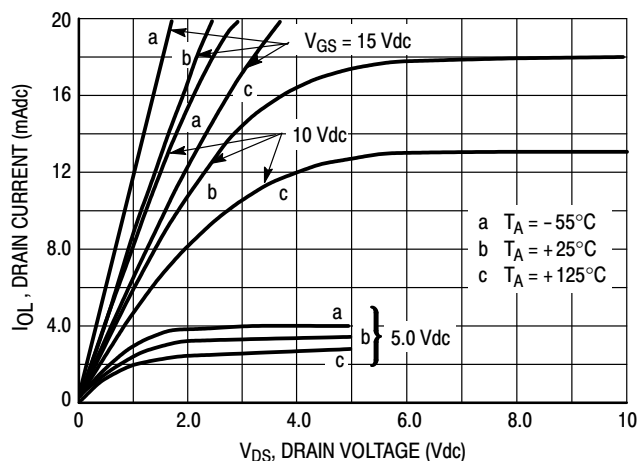


Figure 4. Typical Output Sink Characteristics

These typical curves are not guarantees, but are design aids.
Caution: The maximum current rating is 10 mA per pin.

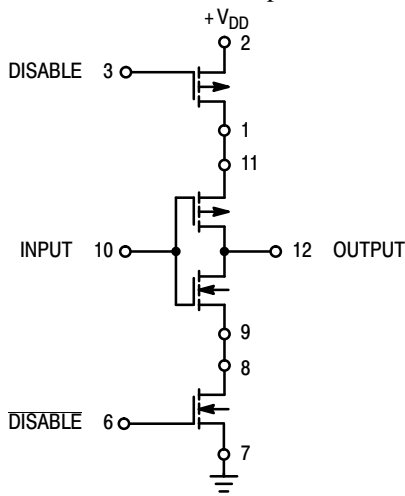
MC14007UB



Figure 5. Switching Time and Power Dissipation Test Circuit and Waveforms

APPLICATIONS

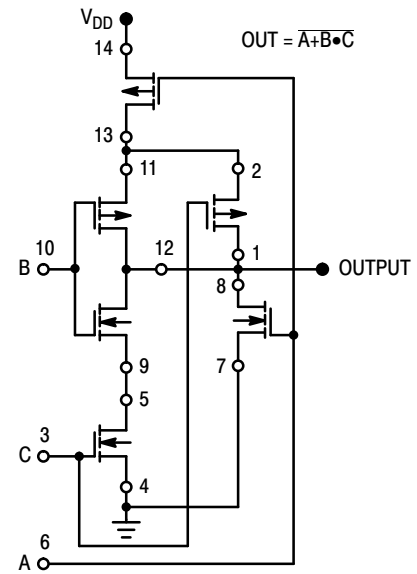
The MC14007UB dual pair plus inverter, which has access to all its elements offers a number of unique circuit applications. Figures 1, 6, and 7 are a few examples of the device flexibility.



| INPUT | DISABLE | OUTPUT |
|-------|---------|--------|
| 1 | 0 | 0 |
| 0 | 0 | 1 |
| X | 1 | OPEN |

X = Don't Care

Figure 6. 3-State Buffer



Substrates of P-Channel devices internally connected to V_{DD} ;
Substrates of N-Channel devices internally connected to V_{SS} .

Figure 7. AOI Functions Using Tree Logic

MC14007UB

ORDERING INFORMATION

| Device | Package | Shipping† |
|-----------------|----------------------|--------------------|
| MC14007UBDG | SOIC-14 (Pb-Free) | 55 Units / Rail |
| MC14007UBDR2G | SOIC-14 (Pb-Free) | 2500 / Tape & Reel |
| NLV14007UBDR2G* | SOIC-14 (Pb-Free) | 2500 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

ON Semiconductor®



SCALE 1:1

SOIC-14 NB
CASE 751A-03
ISSUE L

DATE 03 FEB 2016



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
 2. CONTROLLING DIMENSION: MILLIMETERS.
 3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT MAXIMUM MATERIAL CONDITION.
 4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
 5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 1.35 | 1.75 | 0.054 | 0.068 |
| A1 | 0.10 | 0.25 | 0.004 | 0.010 |
| A3 | 0.19 | 0.25 | 0.008 | 0.010 |
| b | 0.35 | 0.49 | 0.014 | 0.019 |
| D | 8.55 | 8.75 | 0.337 | 0.344 |
| E | 3.80 | 4.00 | 0.150 | 0.157 |
| e | 1.27 BSC | | 0.050 BSC | |
| H | 5.80 | 6.20 | 0.228 | 0.244 |
| h | 0.25 | 0.50 | 0.010 | 0.019 |
| L | 0.40 | 1.25 | 0.016 | 0.049 |
| M | 0° | 7° | 0° | 7° |

SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

GENERIC MARKING DIAGRAM*



- XXXXXX = Specific Device Code
- A = Assembly Location
- WL = Wafer Lot
- Y = Year
- WW = Work Week
- G = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

STYLES ON PAGE 2

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CASE 751A-03
ISSUE L

DATE 03 FEB 2016

STYLE 1:
 PIN 1. COMMON CATHODE
 2. ANODE/CATHODE
 3. ANODE/CATHODE
 4. NO CONNECTION
 5. ANODE/CATHODE
 6. NO CONNECTION
 7. ANODE/CATHODE
 8. ANODE/CATHODE
 9. ANODE/CATHODE
 10. NO CONNECTION
 11. ANODE/CATHODE
 12. ANODE/CATHODE
 13. NO CONNECTION
 14. COMMON ANODE

STYLE 2:
 CANCELLED

STYLE 3:
 PIN 1. NO CONNECTION
 2. ANODE
 3. ANODE
 4. NO CONNECTION
 5. ANODE
 6. NO CONNECTION
 7. ANODE
 8. ANODE
 9. ANODE
 10. NO CONNECTION
 11. ANODE
 12. ANODE
 13. NO CONNECTION
 14. COMMON CATHODE

STYLE 4:
 PIN 1. NO CONNECTION
 2. CATHODE
 3. CATHODE
 4. NO CONNECTION
 5. CATHODE
 6. NO CONNECTION
 7. CATHODE
 8. CATHODE
 9. CATHODE
 10. NO CONNECTION
 11. CATHODE
 12. CATHODE
 13. NO CONNECTION
 14. COMMON ANODE

STYLE 5:
 PIN 1. COMMON CATHODE
 2. ANODE/CATHODE
 3. ANODE/CATHODE
 4. ANODE/CATHODE
 5. ANODE/CATHODE
 6. NO CONNECTION
 7. COMMON ANODE
 8. COMMON CATHODE
 9. ANODE/CATHODE
 10. ANODE/CATHODE
 11. ANODE/CATHODE
 12. ANODE/CATHODE
 13. NO CONNECTION
 14. COMMON ANODE

STYLE 6:
 PIN 1. CATHODE
 2. CATHODE
 3. CATHODE
 4. CATHODE
 5. CATHODE
 6. CATHODE
 7. CATHODE
 8. ANODE
 9. ANODE
 10. ANODE
 11. ANODE
 12. ANODE
 13. ANODE
 14. ANODE

STYLE 7:
 PIN 1. ANODE/CATHODE
 2. COMMON ANODE
 3. COMMON CATHODE
 4. ANODE/CATHODE
 5. ANODE/CATHODE
 6. ANODE/CATHODE
 7. ANODE/CATHODE
 8. ANODE/CATHODE
 9. ANODE/CATHODE
 10. ANODE/CATHODE
 11. COMMON CATHODE
 12. COMMON ANODE
 13. ANODE/CATHODE
 14. ANODE/CATHODE

STYLE 8:
 PIN 1. COMMON CATHODE
 2. ANODE/CATHODE
 3. ANODE/CATHODE
 4. NO CONNECTION
 5. ANODE/CATHODE
 6. ANODE/CATHODE
 7. COMMON ANODE
 8. COMMON ANODE
 9. ANODE/CATHODE
 10. ANODE/CATHODE
 11. NO CONNECTION
 12. ANODE/CATHODE
 13. ANODE/CATHODE
 14. COMMON CATHODE

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