MOTOROLA

# SN54/74LS540
# SN54/74LS541

# OCTAL BUFFER/LINE DRIVER WITH 3-STATE OUTPUTS

**OCTAL BUFFER/LINE DRIVER WITH 3-STATE OUTPUTS**

**LOW POWER SCHOTTKY**

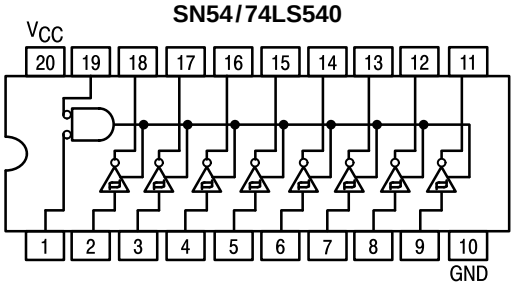
The SN54/74LS540 and SN54/74LS541 are octal buffers and line drivers with the same functions as the LS240 and LS241, but with pinouts on the opposite side of the package.

These device types are designed to be used as memory address drivers, clock drivers and bus-oriented transmitters/receivers. These devices are especially useful as output ports for the microprocessors, allowing ease of layout and greater PC board density.

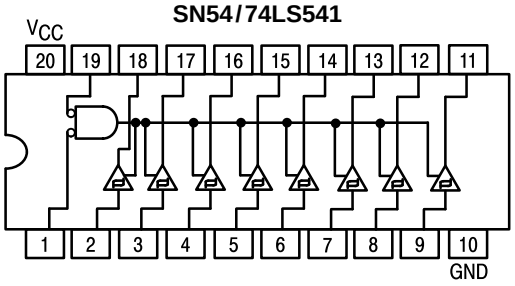
- Hysteresis at Inputs to Improve Noise Margin
- PNP Inputs Reduce Loading
- 3-State Outputs Drive Bus Lines
- Inputs and Outputs Opposite Side of Package, Allowing Easier Interface to Microprocessors
- Input Clamp Diodes Limit High-Speed Termination Effects

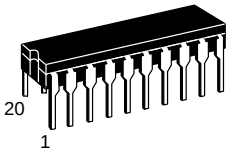
**LOGIC AND CONNECTION DIAGRAMS DIP** (TOP VIEW)

**SN54/74LS540**

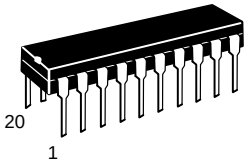



**SN54/74LS541**

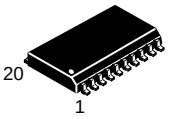



**J SUFFIX**
CERAMIC
CASE 732-03




**N SUFFIX**
PLASTIC
CASE 738-03




**DW SUFFIX**
SOIC
CASE 751D-03

**ORDERING INFORMATION**

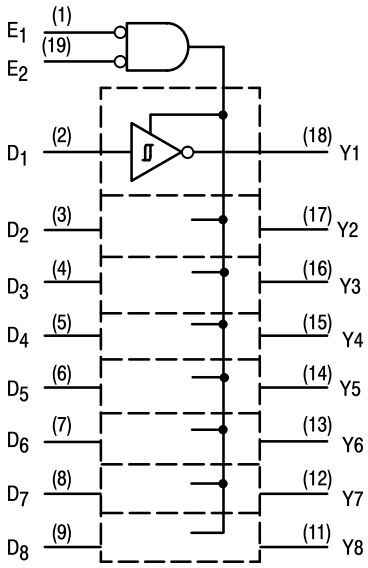
| | |
|---|---|
| SN54LSXXXJ | Ceramic |
| SN74LSXXXN | Plastic |
| SN74LSXXXDW | SOIC |

**GUARANTEED OPERATING RANGES**

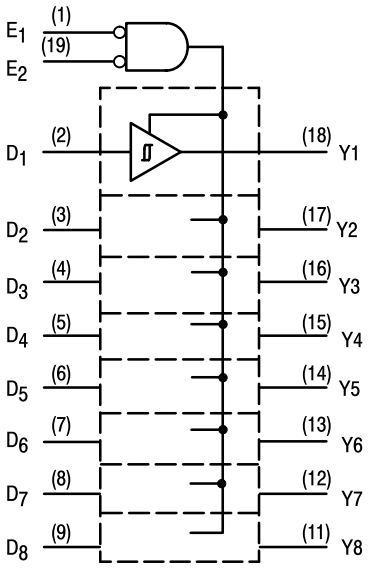
| Symbol | Parameter | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | 54<br>74 | 4.5<br>4.75 | 5.0<br>5.0 | 5.5<br>5.25 | V |
| $T_A$ | Operating Ambient Temperature Range | 54<br>74 | –55<br>0 | 25<br>25 | 125<br>70 | °C |
| $I_{OH}$ | Output Current — High | 54<br>74 | | | –12<br>–15 | mA |
| $I_{OL}$ | Output Current — Low | 54<br>74 | | | 12<br>24 | mA |

## BLOCK DIAGRAM

**LS540**




**LS541**




| INPUTS | | | OUTPUTS | |
|---|---|---|---|---|
| $E_1$ | $E_2$ | D | LS540 | LS541 |
| L | L | H | L | H |
| H | X | X | Z | Z |
| X | H | X | Z | Z |
| L | L | L | H | L |

L = LOW Voltage Level
H = HIGH Voltage Level
X = Immaterial
Z = High Impedance

**DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE** (unless otherwise specified)

| Symbol | Parameter | | Limits Min | Limits Typ | Limits Max | Unit | Test Conditions | |
|---|---|---|---|---|---|---|---|---|
| $V_{IH}$ | Input HIGH Voltage | | 2.0 | | | V | Guaranteed Input HIGH Voltage for All Inputs | |
| $V_{IL}$ | Input LOW Voltage | 54 | | | 0.7 | V | Guaranteed Input LOW Voltage for All Inputs | |
| | | 74 | | | 0.8 | | | |
| $V_{IK}$ | Input Clamp Diode Voltage | | | −0.65 | −1.5 | V | $V_{CC}$ = MIN, $I_{IN}$ = −18 mA | |
| $V_{OH}$ | Output HIGH Voltage | 54, 74 | 2.4 | 3.4 | | V | $V_{CC}$ = MIN, $I_{OH}$ = −3.0 mA | |
| | | 54, 74 | 2.0 | | | V | $V_{CC}$ = MIN, $I_{OH}$ = MAX, $V_{IL}$ = 0.5 V | |
| $V_{OL}$ | Output LOW Voltage | 54, 74 | | 0.25 | 0.4 | V | $I_{OL}$ = 12 mA | $V_{CC}$ = $V_{CC}$ MIN, $V_{IN}$ = $V_{IL}$ or $V_{IH}$ per Truth Table |
| | | 74 | | 0.35 | 0.5 | V | $I_{OL}$ = 24 mA | |
| $V_{T+}$–$V_{T-}$ | Hysteresis | | 0.2 | 0.4 | | V | $V_{CC}$ = MIN | |
| $I_{OZH}$ | Output Off Current HIGH | | | | 20 | μA | $V_{CC}$ = MAX, $V_{OUT}$ = 2.7 V | |
| $I_{OZL}$ | Output Off Current LOW | | | | −20 | μA | $V_{CC}$ = MAX, $V_{OUT}$ = 0.4 V | |
| $I_{IH}$ | Input HIGH Current | | | | 20 | μA | $V_{CC}$ = MAX, $V_{IN}$ = 2.7 V | |
| | | | | | 0.1 | mA | $V_{CC}$ = MAX, $V_{IN}$ = 7.0 V | |
| $I_{IL}$ | Input LOW Current | | | | −0.2 | mA | $V_{CC}$ = MAX, $V_{IN}$ = 0.4 V | |
| $I_{OS}$ | Short Circuit Current (Note 1) | | −40 | | −225 | mA | $V_{CC}$ = MAX | |
| $I_{CC}$ | Power Supply Current Total, Output HIGH | LS540 | | | 25 | mA | $V_{CC}$ = MAX | |
| | | LS541 | | | 32 | mA | | |
| | Total, Output LOW | LS540 | | | 45 | mA | | |
| | | LS541 | | | 52 | mA | | |
| | Total Output 3-State | LS540 | | | 52 | mA | | |
| | | LS541 | | | 55 | mA | | |

Note 1: Not more than one output should be shorted at a time, nor for more than 1 second.

**AC CHARACTERISTICS** ($T_A$ = 25°C)

| Symbol | Parameter | | Limits Min | Limits Typ | Limits Max | Unit | Test Conditions |
|---|---|---|---|---|---|---|---|
| $t_{PLH}$ | Propagation Delay, Data to Output | LS540 | | 9.0 | 15 | ns | $V_{CC}$ = 5.0 V, $C_L$ = 45 pF, $R_L$ = 667 Ω |
| $t_{PLH}$ | | LS541 | | 12 | 15 | | |
| $t_{PHL}$ | | LS540 | | 12 | 15 | | |
| $t_{PHL}$ | | LS541 | | 12 | 18 | | |
| $t_{PZH}$ | Output Enable Time to HIGH Level | LS540 | | 15 | 25 | ns | |
| | | LS541 | | 15 | 32 | | |
| $t_{PZL}$ | Output Enable Time to LOW Level | LS540 | | 20 | 38 | ns | |
| | | LS541 | | 20 | 38 | | |
| $t_{PHZ}$ | Output Disable Time to HIGH Level | LS540 | | 10 | 18 | ns | $C_L$ = 5.0 pF |
| | | LS541 | | 10 | 18 | | |
| $t_{PLZ}$ | Output Disable Time to LOW Level | LS540 | | 15 | 25 | ns | |
| | | LS541 | | 15 | 29 | | |

**AC WAVEFORMS**

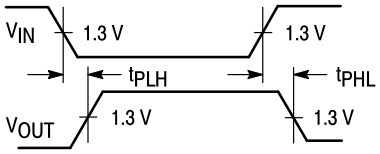



**Figure 1**

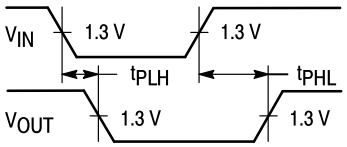



**Figure 2**

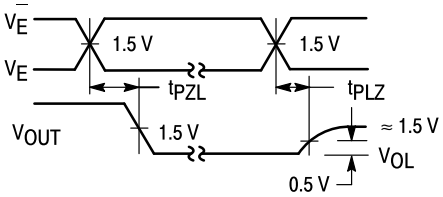



**Figure 3**

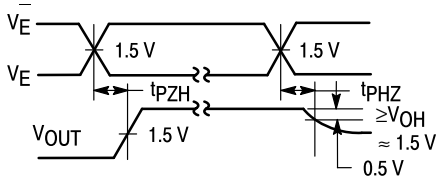
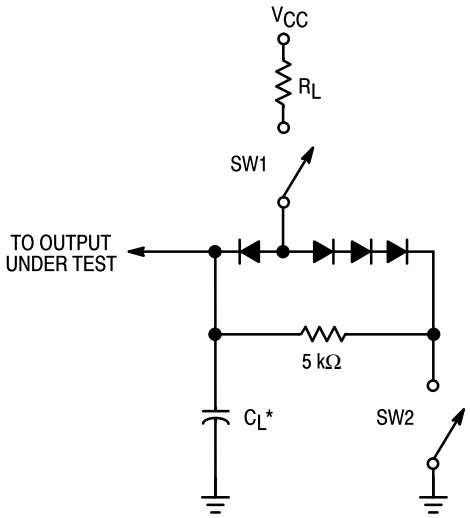



**Figure 4**

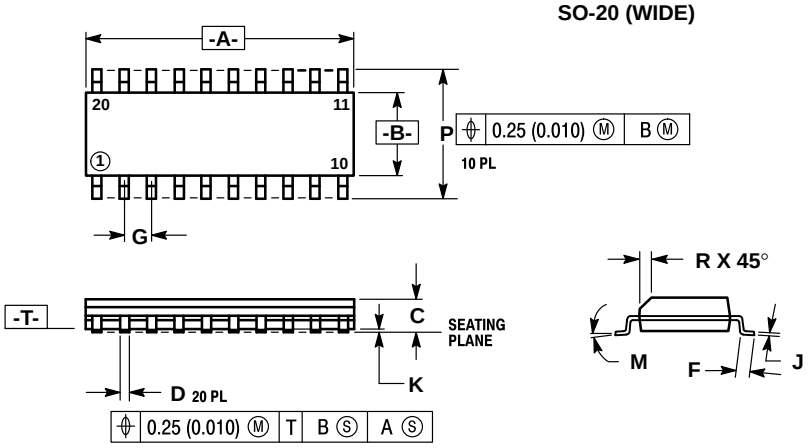



**SWITCH POSITIONS**

| SYMBOL | SW1 | SW2 |
|---|---|---|
| $t_{PZH}$ | Open | Closed |
| $t_{PZL}$ | Closed | Open |
| $t_{PLZ}$ | Closed | Closed |
| $t_{PHZ}$ | Closed | Closed |

**Figure 5**

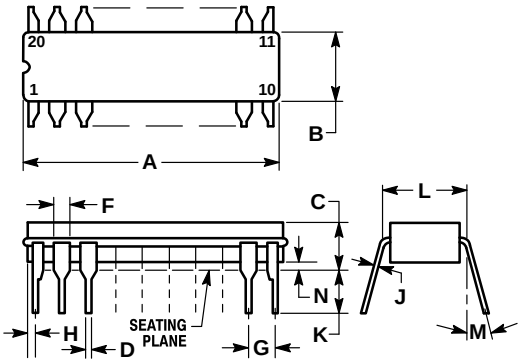
## Case 751D-03 DW Suffix
## 20-Pin Plastic
## SO-20 (WIDE)




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. 751D-01, AND -02 OBSOLETE, NEW STANDARD 751D-03.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 12.65 | 12.95 | 0.499 | 0.510 |
| B | 7.40 | 7.60 | 0.292 | 0.299 |
| C | 2.35 | 2.65 | 0.093 | 0.104 |
| D | 0.35 | 0.49 | 0.014 | 0.019 |
| F | 0.50 | 0.90 | 0.020 | 0.035 |
| G | 1.27 BSC | | 0.050 BSC | |
| J | 0.25 | 0.32 | 0.010 | 0.012 |
| K | 0.10 | 0.25 | 0.004 | 0.009 |
| M | 0° | 7° | 0° | 7° |
| P | 10.05 | 10.55 | 0.395 | 0.415 |
| R | 0.25 | 0.75 | 0.010 | 0.029 |

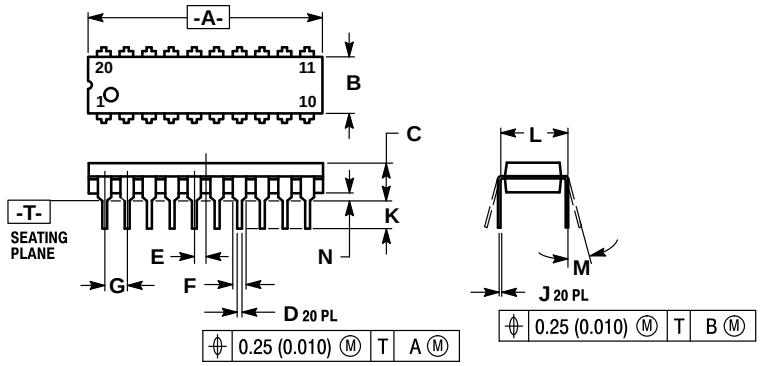
## Case 732-03 J Suffix
## 20-Pin Ceramic Dual In-Line




NOTES:
1. LEADS WITHIN 0.25 mm (0.010) DIA., TRUE POSITION AT SEATING PLANE, AT MAXIMUM MATERIAL CONDITION.
2. DIM L TO CENTER OF LEADS WHEN FORMED PARALLEL.
3. DIM A AND B INCLUDES MENISCUS.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 23.88 | 25.15 | 0.940 | 0.990 |
| B | 6.60 | 7.49 | 0.260 | 0.295 |
| C | 3.81 | 5.08 | 0.150 | 0.200 |
| D | 0.38 | 0.56 | 0.015 | 0.022 |
| F | 1.40 | 1.65 | 0.055 | 0.065 |
| G | 2.54 BSC | | 0.100 BSC | |
| H | 0.51 | 1.27 | 0.020 | 0.050 |
| J | 0.20 | 0.30 | 0.008 | 0.012 |
| K | 3.18 | 4.06 | 0.125 | 0.160 |
| L | 7.62 BSC | | 0.300 BSC | |
| M | 0° | 15° | 0° | 15° |
| N | 0.25 | 1.02 | 0.010 | 0.040 |

## Case 738-03 N Suffix
## 20-Pin Plastic




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION "L" TO CENTER OF LEAD WHEN FORMED PARALLEL.
4. DIMENSION "B" DOES NOT INCLUDE MOLD FLASH.
5. 738-02 OBSOLETE, NEW STANDARD 738-03.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 25.66 | 27.17 | 1.010 | 1.070 |
| B | 6.10 | 6.60 | 0.240 | 0.260 |
| C | 3.81 | 4.57 | 0.150 | 0.180 |
| D | 0.39 | 0.55 | 0.015 | 0.022 |
| E | 1.27 BSC | | 0.050 BSC | |
| F | 1.27 | 1.77 | 0.050 | 0.070 |
| G | 2.54 BSC | | 0.100 BSC | |
| J | 0.21 | 0.38 | 0.008 | 0.015 |
| K | 2.80 | 3.55 | 0.110 | 0.140 |
| L | 7.62 BSC | | 0.300 BSC | |
| M | 0° | 15° | 0° | 15° |
| N | 0.51 | 1.01 | 0.020 | 0.040 |

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| SYMBOL | SW1 | SW2 |
|---|---|---|
| $t_{PZH}$ | Open | Closed |
| $t_{PZL}$ | Closed | Open |
| $t_{PLZ}$ | Closed | Closed |