### function table

Certain differences exist in the $\overline{G}$, $\overline{P}$ ('LS381A, 'S381) and OVR, $C_{n+4}$ ('LS382A) function table compared with similar parts from other technologies and other vendors. No differences exist in the arithmetic modes (B minus A, A minus B, and A plus B), where these outputs perform valuable cascade functions. There are slight differences in the other modes (CLEAR, A + B, A ⊕ B, AB, and PRESET), where these outputs are strictly "don't care".

This function table is a condensed version and assumes for $A_n$ that A0, A1, A2, and A3 inputs all agree and for $B_n$ that B0, B1, B2, and B3 inputs all agree. This table is intended to point out the response of these $\overline{G}$, $\overline{P}$ ('LS381A, 'S381) and OVR, $C_{n+4}$ ('LS382A) outputs in all modes of operation to facilitate incoming inspection.

FUNCTION TABLE

| ARITHMETIC/LOGIC OPERATION | INPUTS | | | | | | OUTPUTS | | | | ('LS381A, 'S381) | | ('LS382A) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | S2 | S1 | S0 | $C_n$ | $A_n$ | $B_n$ | F3 | F2 | F1 | F0 | $\overline{G}$ | $\overline{P}$ | OVR | $C_{n+4}$ |
| CLEAR | L | L | L | X | X | X | L | L | L | L | H | H | L | L |
| B MINUS A | L | L | H | L | L | L | H | H | H | H | H | L | L | L |
| | | | | L | L | H | H | H | H | L | L | H | L | H |
| | | | | L | H | L | L | L | L | L | H | H | L | L |
| | | | | L | H | H | H | H | H | H | H | L | L | L |
| | | | | H | L | L | L | L | L | L | H | L | L | H |
| | | | | H | L | H | H | H | H | H | L | H | L | H |
| | | | | H | H | L | L | L | L | H | H | H | L | L |
| | | | | H | H | H | L | L | L | L | H | L | L | H |
| A MINUS B | L | H | L | L | L | L | H | H | H | H | H | L | L | L |
| | | | | L | L | H | L | L | L | L | H | L | L | H |
| | | | | L | H | L | H | H | H | H | H | L | L | L |
| | | | | L | H | H | H | H | H | L | L | H | L | H |
| | | | | H | L | L | L | L | L | H | H | H | L | L |
| | | | | H | L | H | L | L | L | L | H | L | L | H |
| | | | | H | H | L | H | H | H | H | L | H | L | H |
| | | | | H | H | H | L | L | L | L | H | L | L | H |
| A PLUS B | L | H | H | L | L | L | L | L | L | L | H | H | L | L |
| | | | | L | L | H | H | H | H | H | H | L | L | L |
| | | | | L | H | L | H | H | H | H | H | L | L | L |
| | | | | L | H | H | H | H | H | L | L | H | L | H |
| | | | | H | L | L | L | L | L | H | H | H | L | L |
| | | | | H | L | H | L | L | L | L | H | L | L | H |
| | | | | H | H | L | L | L | L | L | H | L | L | H |
| | | | | H | H | H | H | H | H | H | L | H | L | H |
| A ⊕ B | H | L | L | X | L | L | L | L | L | L | H | H | L | L |
| | | | | L | L | H | H | H | H | H | H | L | L | L |
| | | | | H | L | H | H | H | H | H | H | L | H | H |
| | | | | L | H | L | H | H | H | H | H | L | L | L |
| | | | | H | H | L | H | H | H | H | H | L | H | H |
| | | | | X | H | H | L | L | L | L | H | H | L | L |
| A + B | H | L | H | X | L | L | L | L | L | L | H | H | L | L |
| | | | | L | L | H | H | H | H | H | H | L | L | L |
| | | | | H | L | H | H | H | H | H | H | L | H | H |
| | | | | L | H | L | H | H | H | H | H | L | L | L |
| | | | | H | H | L | H | H | H | H | H | L | H | H |
| | | | | L | H | H | H | H | H | H | H | L | L | L |
| | | | | H | H | H | H | H | H | H | H | L | H | H |
| AB | H | H | L | X | L | L | L | L | L | L | H | H | L | L |
| | | | | X | L | H | L | L | L | L | H | H | L | L |
| | | | | X | H | L | L | L | L | L | H | H | L | L |
| | | | | L | H | H | H | H | H | H | H | L | L | L |
| | | | | H | H | H | H | H | H | H | H | L | H | H |
| PRESET | H | H | H | L | X | X | H | H | H | H | H | L | L | L |
| | | | | H | X | X | H | H | H | H | H | L | H | H |



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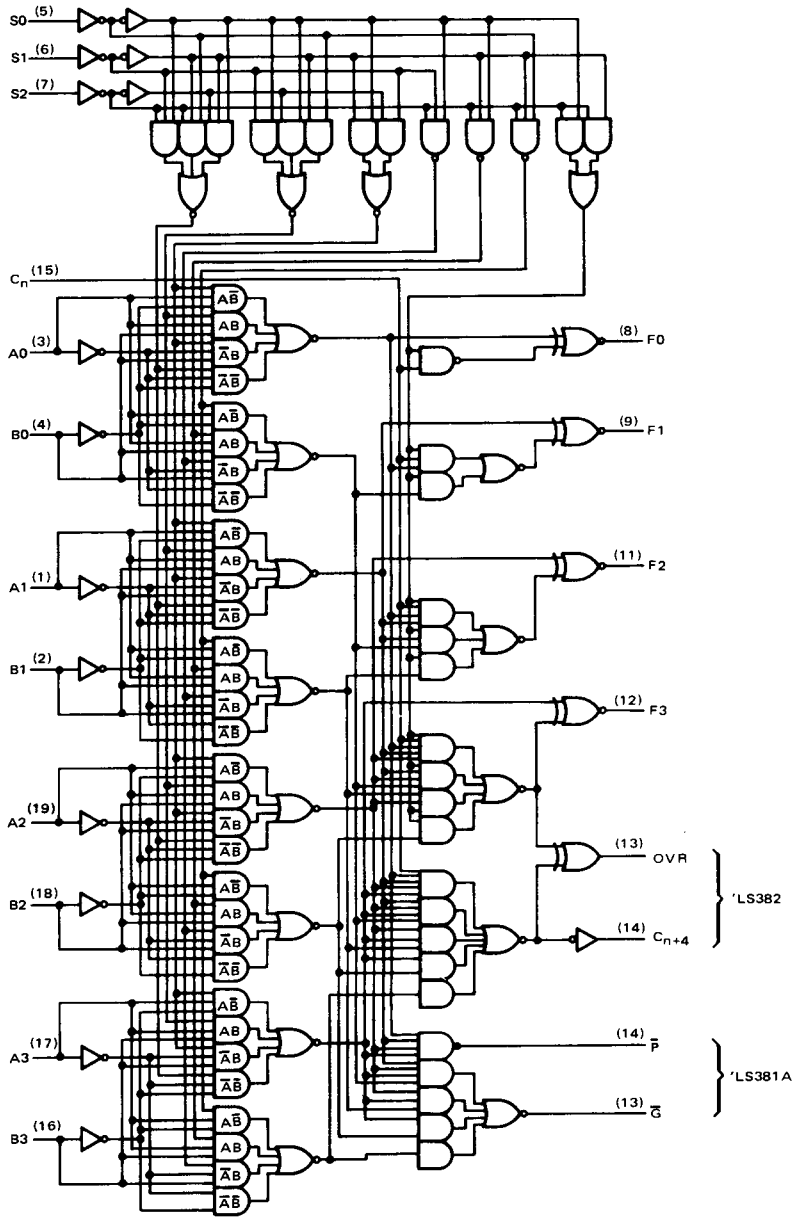
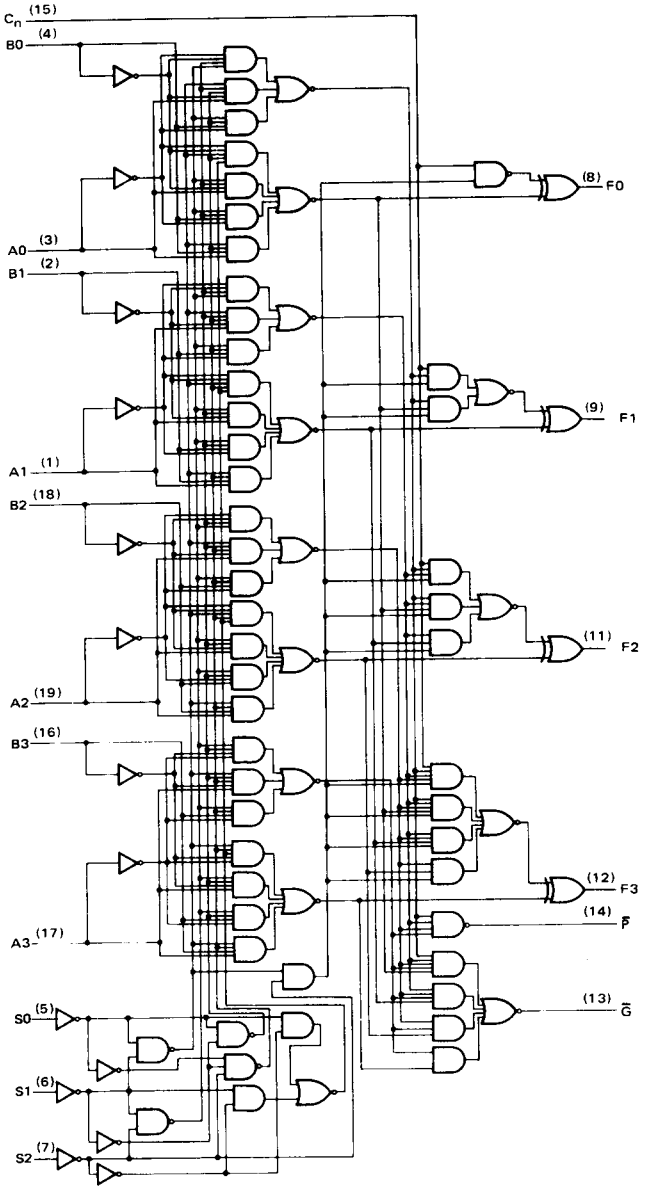
**logic diagram (positive logic)** 'LS381A, 'LS382A




Pin numbers shown are for DW, J, N, and W packages.

## logic diagram and schematics of inputs and outputs

'S381




Pin numbers shown are for DW, J, N, and W packages.



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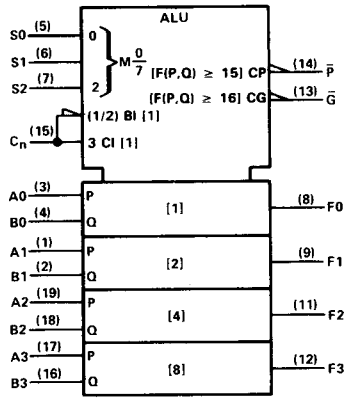
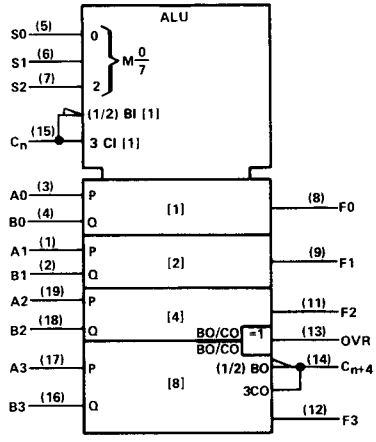
## logic symbols†

'LS381A, 'S381




'LS382 A

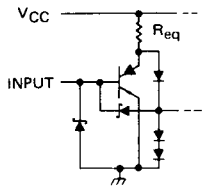



†These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
Pin numbers shown are for DW, J, N, and W packages.

## schematics of inputs and outputs

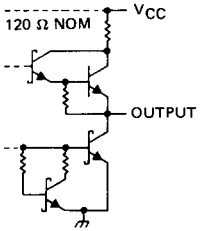
'LS381, 'LS382A

EQUIVALENT OF EACH INPUT



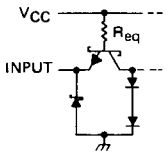

Any S: $R_{eq}$ = 10 kΩ
$C_n$ ('LS381A): $R_{eq}$ = 2.5 kΩ
All others: $R_{eq}$ = 2 kΩ

TYPICAL OF ALL OUTPUTS



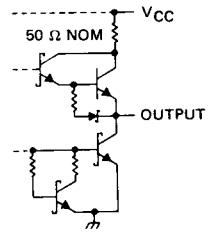

'S381

EQUIVALENT OF EACH INPUT




Any A or B: $R_{eq}$ = 1 kΩ
$C_n$: $R_{eq}$ = 800 Ω
Any S: $R_{eq}$ = 6 kΩ

TYPICAL OF ALL OUTPUTS



### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, $V_{CC}$ (See Note 1) . . . . . 7 V
Input voltage . . . . . 7 V
Operating free-air temperature range: SN54LS381A, SN54LS382A . . . . . −55°C to 125°C
SN74LS381A, SN74LS382A . . . . . 0°C to 70°C
Storage temperature range . . . . . −65°C to 150°C

NOTE 1: Voltage values are with respect to the network ground terminal.

### recommended operating conditions

| | | | SN54LS' | | | SN74LS' | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | NOM | MAX | MIN | NOM | MAX | |
| $V_{CC}$ | Supply voltage | | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| $V_{IH}$ | High-level input voltage | | 2 | | | 2 | | | V |
| $V_{IL}$ | Low-level input voltage | | | | 0.7 | | | 0.8 | V |
| $I_{OH}$ | High-level output current | | | | −0.4 | | | −0.4 | mA |
| $I_{OL}$ | Low-level output current | $\overline{G}$ output of 'LS381A | | | 16 | | | 16 | mA |
| | | All other outputs | | | 4 | | | 8 | |
| $T_A$ | Operating free-air temperature | | −55 | | 125 | 0 | | 70 | °C |

### electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS† | | SN54LS' | | | SN74LS' | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | |
| $V_{IK}$ | | $V_{CC}$ = MIN, $I_I$ = −18 mA | | | | −1.5 | | | −1.5 | V |
| $V_{OH}$ | | $V_{CC}$ = MIN, $V_{IH}$ = 2 V, $V_{IL}$ = MAX, $I_{OH}$ = −0.4 mA | | 2.5 | 3.4 | | 2.7 | 3.4 | | V |
| $V_{OL}$ | $\overline{G}$ ('LS381A) | $V_{CC}$ = MIN, $V_{IH}$ = 2 V, $V_{IL}$ = MAX | $I_{OL}$ = 16 mA | | 0.47 | 0.7 | | 0.47 | 0.7 | V |
| | Other outputs | | $I_{OL}$ = 4 mA | | 0.25 | 0.4 | | 0.25 | 0.4 | |
| | | | $I_{OL}$ = 8 mA | | | | | 0.35 | 0.5 | |
| $I_I$ | | $V_{CC}$ = MAX, $V_I$ = 7 V | | | | 0.1 | | | 0.1 | mA |
| $I_{IH}$ | Any S | $V_{CC}$ = MAX, $V_I$ = 2.7 V | | | | 20 | | | 20 | μA |
| | Any A or B | | | | | 100 | | | 100 | |
| | $C_n$ ('LS381A) | | | | | 80 | | | 80 | |
| | $C_n$ ('LS382A) | | | | | 100 | | | 100 | |
| $I_{IL}$ | Any S | $V_{CC}$ = MAX, $V_I$ = 0.4 V | | | | −0.2 | | | −0.2 | mA |
| | Any A or B | | | | | −1 | | | −1 | |
| | $C_n$ ('LS381A) | | | | | −0.8 | | | −0.8 | |
| | $C_n$ ('LS382A) | | | | | −0.8 | | | −0.8 | |
| $I_{OS}$§ | | $V_{CC}$ = MAX | | −20 | | −100 | −20 | | −100 | mA |
| $I_{CC}$ | | $V_{CC}$ = MAX, All inputs grounded, outputs open | | | 35 | 65 | | 35 | 65 | mA |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values are at $V_{CC}$ = 5 V, $T_A$ = 25°C.
§ Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second.





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**switching characteristics, $V_{CC}$ = 5 V, $T_A$ = 25°C (see note 3)**

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | 'LS381A | | | 'LS382 | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| $t_{PLH}$ | Cn | Any F | $R_L$ = 2 kΩ, $C_L$ = 15 pF | | 18 | 27 | | 18 | 27 | ns |
| $t_{PHL}$ | | | | | 14 | 21 | | 14 | 21 | |
| $t_{PLH}$ | Any A or B | $\overline{G}$ | | | 20 | 30 | | | | ns |
| $t_{PHL}$ | | | | | 21 | 33 | | | | |
| $t_{PLH}$ | Any A or B | $\overline{P}$ | | | 21 | 33 | | | | ns |
| $t_{PHL}$ | | | | | 23 | 33 | | | | |
| $t_{PLH}$ | $A_i$ or $B_i$ | $F_i$ | | | 20 | 30 | | 20 | 30 | ns |
| $t_{PHL}$ | | | | | 15 | 23 | | 15 | 23 | |
| $t_{PLH}$ | S0, S1, S2 | $F_i$ | | | 35 | 53 | | 35 | 53 | ns |
| $t_{PHL}$ | | | | | 34 | 51 | | 34 | 51 | |
| $t_{PLH}$ | S0, S1, S2 | $\overline{G}$ or $\overline{P}$ | | | 31 | 47 | | | | ns |
| $t_{PHL}$ | | | | | 32 | 48 | | | | |
| $t_{PLH}$ | Any A or B | $C_{n+4}$ | | | | | | 28 | 42 | ns |
| $t_{PHL}$ | | | | | | | | 26 | 39 | |
| $t_{PLH}$ | Any A or B | OVR | | | | | | 23 | 35 | ns |
| $t_{PHL}$ | | | | | | | | 27 | 41 | |
| $t_{PLH}$ | S0, S1, S2 | $C_{n+4}$ or OVR | | | | | | 38 | 57 | ns |
| $t_{PHL}$ | | | | | | | | 36 | 54 | |
| $t_{PLH}$ | $C_n$ | OVR | | | | | | 10 | 15 | ns |
| $t_{PHL}$ | | | | | | | | 13 | 23 | |
| $t_{PLH}$ | $C_n$ | $C_{n+4}$ | | | | | | 13 | 21 | ns |
| $t_{PHL}$ | | | | | | | | 11 | 20 | |

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, $V_{CC}$ (see Note 1) . . . . . 7 V
Input voltage . . . . . 5.5 V
Interemitter voltage (see Note 2) . . . . . 5.5 V
Operating free-air temperature range: SN54S381 . . . . . −55°C to 125°C
SN74S381 . . . . . 0°C to 70°C
Storage free-air temperature range . . . . . −65°C to 150°C

NOTES: 1. Voltage values, except interemitter voltage, are with respect to network ground terminal.
2. This is the voltage between two emitters of a multiple-emitter transistor. For this circuit, this rating applies to each A input in conjunction with its respective B input; for example A0 with B0, etc.

## recommended operating conditions

| | SN54S381 | | | SN74S381 | | | UNIT |
|---|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | MIN | NOM | MAX | |
| Supply voltage, $V_{CC}$ | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| High-level output current, $I_{OH}$ | | | −1 | | | −1 | mA |
| Low-level output current, $I_{OL}$ | | | 20 | | | 20 | mA |
| Operating free-air temperature, $T_A$ | −55 | | 125 | 0 | | 70 | °C |

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | | | TEST CONDITIONS† | MIN | TYP‡ | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| $V_{IH}$ | High-level input voltage | | | 2 | | | V |
| $V_{IL}$ | Low-level input voltage | | | | | 0.8 | V |
| $V_{IK}$ | Input clamp voltage | | $V_{CC}$ = MIN, $I_I$ = −18 mA | | | −1.2 | V |
| $V_{OH}$ | High-level output voltage | SN54S381 | $V_{CC}$ = MIN, $V_{IH}$ = 2 V, $V_{IL}$ = 0.8 V, $I_{OH}$ = −1 mA | 2.4 | 3.4 | | V |
| | | SN74S381 | | 2.7 | 3.4 | | |
| $V_{OL}$ | Low-level output voltage | | $V_{CC}$ = MIN, $V_{IH}$ = 2 V, $V_{IL}$ = 0.8 V, $I_{OL}$ = 20 mA | | | 0.5 | V |
| $I_I$ | Input current at maximum input voltage | | $V_{CC}$ = MAX, $V_I$ = 5.5 V | | | 1 | mA |
| $I_{IH}$ | High-level input current | Any S input | $V_{CC}$ = MAX, $V_I$ = 2.7 V | | | 50 | µA |
| | | $C_n$ | | | | 250 | |
| | | All others | | | | 200 | |
| $I_{IL}$ | Low-level input current | Any S input | $V_{CC}$ = MAX, $V_I$ = 0.5 V | | | −2 | mA |
| | | $C_n$ | | | | −8 | |
| | | All others | | | | −6 | |
| $I_{OS}$ | Short-circuit output current§ | | $V_{CC}$ = MAX | −40 | | −100 | mA |
| $I_{CC}$ | Supply current | | $V_{CC}$ = MAX | | 105 | 160 | mA |

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡All typical values are at $V_{CC}$ = 5 V, $T_A$ = 25°C.
§Not more than one output should be shorted at a time.

## switching characteristics, $V_{CC}$ = 5 V, $T_A$ = 25°C

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| $t_{PLH}$ | $C_n$ | Any F | $C_L$ = 15 pF, $R_L$ = 280 Ω, See Note 3 | | 10 | 17 | ns |
| $t_{PHL}$ | | | | | 10 | 17 | |
| $t_{PLH}$ | Any A or B | $\overline{G}$ | | | 12 | 20 | ns |
| $t_{PHL}$ | | | | | 12 | 20 | |
| $t_{PLH}$ | Any A or B | $\overline{P}$ | | | 11 | 18 | ns |
| $t_{PHL}$ | | | | | 11 | 18 | |
| $t_{PLH}$ | $A_i$ or $B_i$ | $F_i$ | | | 18 | 27 | ns |
| $t_{PHL}$ | | | | | 16 | 25 | |
| $t_{PLH}$ | Any S | Any | | | 18 | 30 | ns |
| $t_{PHL}$ | | | | | 18 | 30 | |

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.





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