MOTOROLA

# 8-BIT MAGNITUDE COMPARATORS

**SN54/74LS682**
**SN54/74LS684**
**SN54/74LS688**

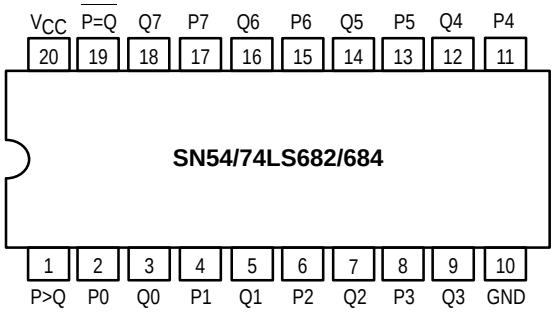
**8-BIT MAGNITUDE COMPARATORS**

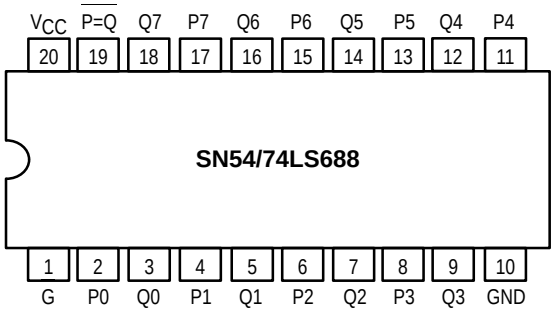
**LOW POWER SCHOTTKY**

The SN54/74LS682, 684, 688 are 8-bit magnitude comparators. These device types are designed to perform comparisons between two eight-bit binary or BCD words. All device types provide P = Q outputs and the LS682 and LS684 have P>Q outputs also.

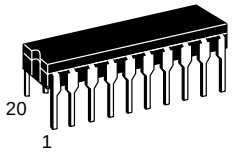
The LS682, LS684 and LS688 are totem pole devices. The LS682 has a 20 kΩ pullup resistor on the Q inputs for analog or switch data.

**CONNECTION DIAGRAMS** (TOP VIEW)

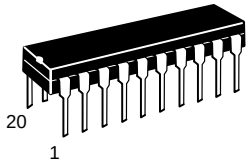


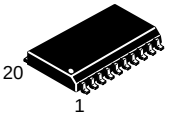

| TYPE | $\overline{P = Q}$ | $\overline{P > Q}$ | OUTPUT ENABLE | OUTPUT CONFIGURATION | PULLUP |
|---|---|---|---|---|---|
| LS682 | yes | yes | no | totem-pole | yes |
| LS684 | yes | yes | no | totem-pole | no |
| LS688 | yes | no | yes | totem-pole | no |




**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 |

**FUNCTION TABLE**

| INPUTS | | | OUTPUTS | |
|---|---|---|---|---|
| DATA | ENABLES | | | |
| P, Q | $\overline{G}$, $\overline{GT}$ | $\overline{G2}$ | $\overline{P = Q}$ | $\overline{P > Q}$ |
| P = Q | L | L | L | H |
| P > Q | L | L | H | L |
| P < Q | L | L | H | H |
| X | H | H | H | H |

H = HIGH Level, L = LOW Level, X = Irrelevant

## GUARANTEED OPERATING RANGES

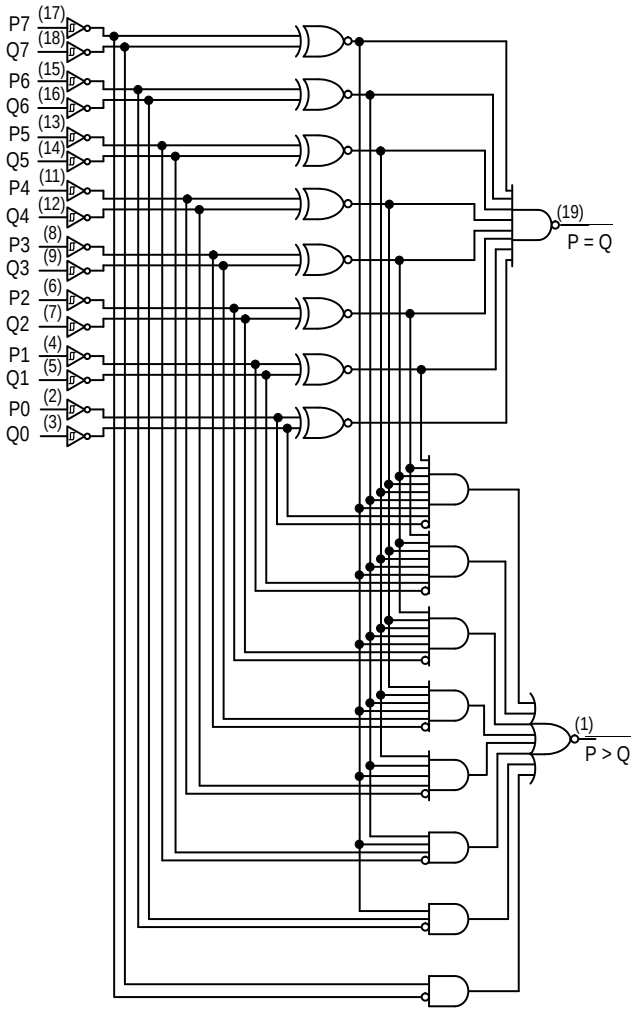
| Symbol | Parameter | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | 54<br>74 | 4.5<br>4.75 | 5.0<br>5.0 | 5.5<br>5.25 | V |
| $T_A$ | Operating Ambient Temperature Range | 54<br>74 | –55<br>0 | 25<br>25 | 125<br>70 | °C |
| $I_{OH}$ | Output Current — High | 54, 74 | | | –0.4 | mA |
| $I_{OL}$ | Output Current — Low | 54<br>74 | | | 12<br>24 | mA |

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

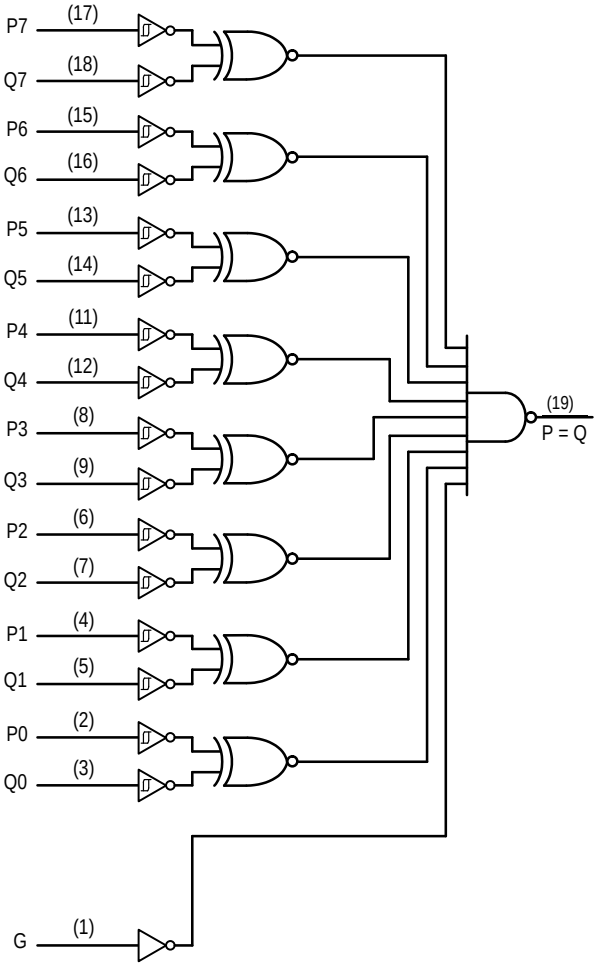
| Symbol | Parameter | | Limits Min | Limits Typ | Limits Max | Unit | Test Conditions | |
|---|---|---|---|---|---|---|---|---|
| $V_{IH}$ | Input HIGH Voltage | | 2.0 | | | V | Guaranteed Input HIGH Voltage for All Inputs | |
| $V_{IL}$ | Input LOW Voltage | 54 | | | 0.7 | V | Guaranteed Input LOW 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 | 2.5 | 3.5 | | V | $V_{CC}$ = MIN, $I_{OH}$ = MAX, $V_{IN}$ = $V_{IH}$ or $V_{IL}$ per Truth Table | |
| | | 74 | 2.7 | 3.5 | | 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 | |
| $I_{IH}$ | Input HIGH Current | | | | 20 | µA | $V_{CC}$ = MAX, $V_{IN}$ = 2.7 V | |
| | | LS628-Q Inputs | | | 0.1 | mA | $V_{CC}$ = MAX, $V_{IN}$ = 5.5 V | |
| | | Others | | | 0.1 | mA | $V_{CC}$ = MAX, $V_{IN}$ = 7.0 V | |
| $I_{IL}$ | Input LOW Current | LS682-Q Inputs | | | –0.4 | mA | $V_{CC}$ = MAX, $V_{IN}$ = 0.4 V | |
| | | Others | | | –0.2 | mA | | |
| $I_{OS}$ | Short Circuit Current (Note 1) | | –30 | | –130 | mA | $V_{CC}$ = MAX | |
| $I_{CC}$ | Power Supply Current | LS682 | | | 70 | mA | $V_{CC}$ = MAX | |
| | | LS684 | | | 65 | mA | | |
| | | LS688 | | | 65 | mA | | |

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

## LOGIC DIAGRAMS




**SN54/74LS682 thru LS684**




**SN54/74LS688**

**AC CHARACTERISTICS** ($T_A$ = 25°C)

**SN54/74LS682**

| Symbol | Parameter | Limits | | | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay, P to $\overline{P = Q}$ | | 13<br>15 | 25<br>25 | ns | $V_{CC}$ = 5.0 V<br>$C_L$ = 45 pF<br>$R_L$ = 667 Ω |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay, Q to $\overline{P = Q}$ | | 14<br>15 | 25<br>25 | ns | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay, P to $\overline{P > Q}$ | | 20<br>15 | 30<br>30 | ns | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay, Q to $\overline{P > Q}$ | | 21<br>19 | 30<br>30 | ns | |

**SN54/74LS684**

| Symbol | Parameter | Limits | | | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay, P to $\overline{P = Q}$ | | 15<br>17 | 25<br>25 | ns | $V_{CC}$ = 5.0 V<br>$C_L$ = 45 pF<br>$R_L$ = 667 Ω |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay, Q to $\overline{P = Q}$ | | 16<br>15 | 25<br>25 | ns | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay, P to $\overline{P > Q}$ | | 22<br>17 | 30<br>30 | ns | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay, Q to $\overline{P > Q}$ | | 24<br>20 | 30<br>30 | ns | |

**SN54/74LS688**

| Symbol | Parameter | Limits | | | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay, P to $\overline{P = Q}$ | | 12<br>17 | 18<br>23 | ns | $V_{CC}$ = 5.0 V<br>$C_L$ = 45 pF<br>$R_L$ = 667 Ω |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay, Q to $\overline{P = Q}$ | | 12<br>17 | 18<br>23 | ns | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay, $\overline{G}$ , $\overline{G1}$ to $\overline{P = Q}$ | | 12<br>13 | 18<br>20 | ns | |