



**MOTOROLA**

**DESCRIPTION** — The SN54LS/74LS682 thru SN54LS/74LS689 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  $\overline{P=Q}$  outputs and the LS682 thru LS687 have  $\overline{P > Q}$  outputs also.

The LS682, LS684, LS686 and LS688 are totem pole devices. The LS683, LS685, LS687 and LS689 are open-collector devices.

The LS682 and LS683 have a 20 kΩ pullup resistor on the Q inputs for analog or switch data.

**SN54LS/74LS682  
thru  
SN54LS/74LS689**

**8-BIT MAGNITUDE  
COMPARATORS**

**LOW POWER SCHOTTKY**

**FUNCTION TABLE**

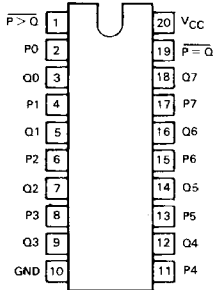
TYPE	$\overline{P=Q}$	$\overline{P > Q}$	OUTPUT ENABLE	OUTPUT CONFIGURATION	PULLUP
LS683	yes	yes	no	open-collector	yes
LS684	yes	yes	no	totem-pole	no
LS685	yes	yes	nc	open-collector	no
LS686	yes	yes	yes	totem-pole	no
LS687	yes	yes	yes	open-collector	no
LS688	yes	no	yes	totem-pole	no
LS689	yes	no	yes	open-collector	no

INPUTS			OUTPUTS	
DATA	ENABLES		$\overline{P=Q}$	$\overline{P > Q}$
P, Q	$\overline{G}, \overline{G1}$	$\overline{G2}$		
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

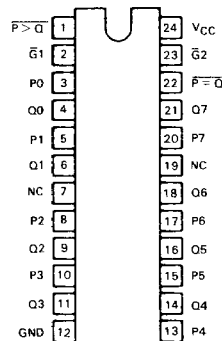
**CONNECTION DIAGRAMS  
(TOP VIEW)**

**SN54LS/74LS682  
THRU  
SN54LS/74LS685**



J Suffix — Case 732-03 (Ceramic)  
N Suffix — Case 738-01 (Plastic)

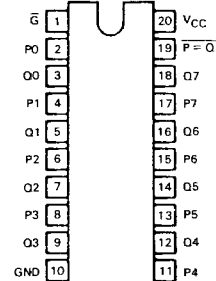
**SN54LS/74LS686  
SN54LS/74LS687**



NC = no connection

J Suffix — Case 758-01 (Ceramic)  
N Suffix — Case 724-02 (Plastic)

**SN54LS/74LS688  
SN54LS/74LS689**



J Suffix — Case 732-03 (Ceramic)  
N Suffix — Case 738-01 (Plastic)

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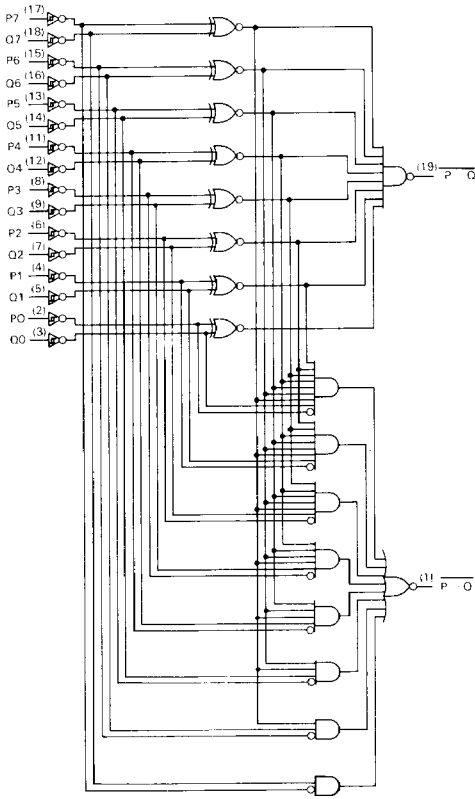
**GUARANTEED OPERATING RANGES**

SYMBOL	PARAMETER		MIN	TYP	MAX	UNIT
V <sub>CC</sub>	Supply Voltage	54 74	4.5 4.75	5.0 5.0	5.5 5.25	V
T <sub>A</sub>	Operating Ambient Temperature Range	54 74	-55 0	25 25	125 70	°C
I <sub>OH</sub>	Output Current — High	54,74			-0.4	mA
I <sub>OL</sub>	Output Current — Low	54 74			12 24	mA

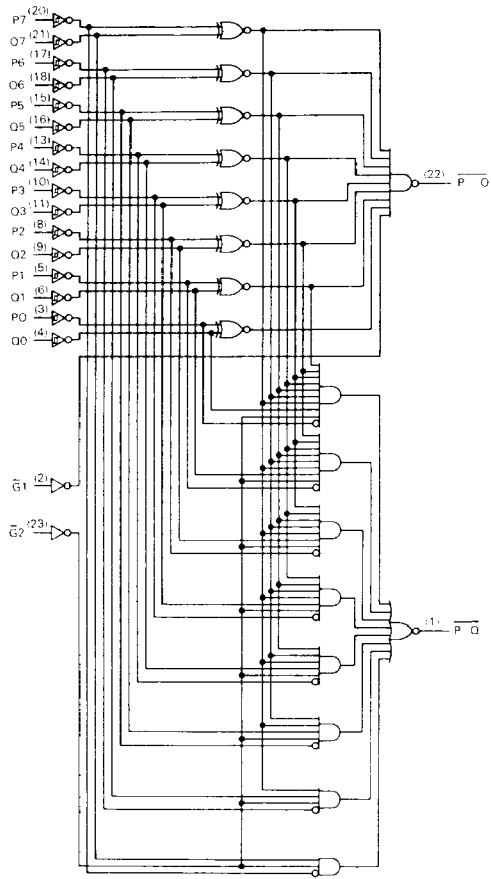
**DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE** (unless otherwise specified)

SYMBOL	PARAMETER		LIMITS			UNITS	TEST CONDITIONS
			MIN	TYP	MAX		
V <sub>IH</sub>	Input HIGH Voltage		2.0			V	Guaranteed Input HIGH Voltage for All Inputs
V <sub>IL</sub>	Input LOW Voltage	54			0.7	V	Guaranteed Input LOW Voltage for All Inputs
		74			0.8		
V <sub>IK</sub>	Input Clamp Diode Voltage			-0.65	-1.5	V	V <sub>CC</sub> = MIN, I <sub>IN</sub> = -18 mA
V <sub>OH</sub>	Output HIGH Voltage	54	2.5	3.5		V	V <sub>CC</sub> = MIN, I <sub>OH</sub> = MAX, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> per Truth Table
		74	2.7	3.5		V	
V <sub>OL</sub>	Output LOW Voltage	54,74		0.25	0.4	V	I <sub>OL</sub> = 12 mA
		74		0.35	0.5	V	I <sub>OL</sub> = 24 mA
I <sub>IH</sub>	Input HIGH Current				20	μA	V <sub>CC</sub> = MAX, V <sub>IN</sub> = 2.7 V
		LS682-Q Inputs			0.1	mA	V <sub>CC</sub> = MAX, V <sub>IN</sub> = 5.5 V
		Others			0.1	mA	V <sub>CC</sub> = MAX, V <sub>IN</sub> = 7.0 V
I <sub>IL</sub>	Input LOW Current	LS682-Q Inputs			-0.4	mA	V <sub>CC</sub> = MAX, V <sub>IN</sub> = 0.4 V
		Others			-0.2	mA	
I <sub>OS</sub>	Short Circuit Current		-30		-130	mA	V <sub>CC</sub> = MAX
I <sub>CC</sub>	Power Supply Current	LS682			70	mA	V <sub>CC</sub> = MAX
		LS684			65	mA	
		LS686			75	mA	
		LS688			65	mA	

BLOCK DIAGRAMS

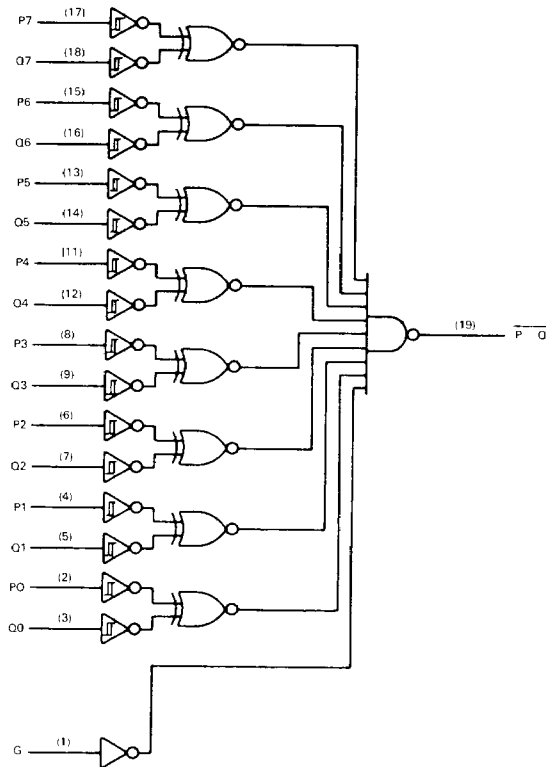


SN54LS/74LS682 thru LS685



SN54LS/74LS686, LS687

BLOCK DIAGRAM



SN54LS/74LS688, LS689

**GUARANTEED OPERATING RANGES**

SYMBOL	PARAMETER		MIN	TYP	MAX	UNIT
V <sub>CC</sub>	Supply Voltage	54 74	4.5 4.75	5.0 5.0	5.5 5.25	V
T <sub>A</sub>	Operating Ambient Temperature Range	54 74	-55 0	25 25	125 70	°C
V <sub>OH</sub>	Output Voltage — High	54,74			5.5	V
I <sub>OL</sub>	Output Current — Low	54 74			12 24	mA

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

SYMBOL	PARAMETER	LIMITS			UNITS	TEST CONDITIONS
		MIN	TYP	MAX		
V <sub>IH</sub>	Input HIGH Voltage	2.0			V	Guaranteed Input HIGH Voltage for All Inputs
V <sub>IL</sub>	Input LOW Voltage	54		0.7	V	Guaranteed Input LOW Voltage for All Inputs
		74		0.8		
V <sub>IK</sub>	Input Clamp Diode Voltage		-0.65	-1.5	V	V <sub>CC</sub> = MIN, I <sub>IN</sub> = -18 mA
I <sub>OH</sub>	Output HIGH Current	54		250	μA	V <sub>CC</sub> = MIN, V <sub>OH</sub> = MAX
		74		100	μA	
V <sub>OL</sub>	Output LOW Voltage	54,74	0.25	0.4	V	I <sub>OL</sub> = 12 mA I <sub>OL</sub> = 24 mA V <sub>CC</sub> = V <sub>CC</sub> MIN, V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> per Truth Table
		74	0.35	0.5	V	
I <sub>IH</sub>	Input HIGH Current			20	μA	V <sub>CC</sub> = MAX, V <sub>IN</sub> = 2.7 V
		LS683-Q Inputs		0.1	mA	V <sub>CC</sub> = MAX, V <sub>IN</sub> = 5.5 V
		Others		0.1	mA	V <sub>CC</sub> = MAX, V <sub>IN</sub> = 7.0 V
I <sub>IL</sub>	Input LOW Current	LS683-Q Inputs		-0.4	mA	V <sub>CC</sub> = MAX, V <sub>IN</sub> = 0.4 V
		Others		-0.2	mA	
I <sub>CC</sub>	Power Supply Current	LS683		70	mA	V <sub>CC</sub> = MAX
		LS685		65	mA	
		LS687		75	mA	
		LS689		65	mA	

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**SN54LS/74LS682 THRU SN54LS/74LS685**

**AC CHARACTERISTICS:**  $T_A = 25^\circ\text{C}$

**SN54LS/74LS682**

SYMBOL	PARAMETER	LIMITS			UNITS	TEST CONDITIONS
		MIN	TYP	MAX		
$t_{PLH}$ $t_{PHL}$	Propagation Delay, P to $\overline{P} = \overline{Q}$		13 15	25 25	ns	$V_{CC} = 5.0\text{ V}$ $C_L = 45\text{ pF}$ $R_L = 667\ \Omega$
$t_{PLH}$ $t_{PHL}$	Propagation Delay, Q to $\overline{P} = \overline{Q}$		14 15	25 25	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay, P to $\overline{P} > \overline{Q}$		20 15	30 30	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay, Q to $\overline{P} > \overline{Q}$		21 19	30 30	ns	

**SN54LS/74LS683**

SYMBOL	PARAMETER	LIMITS			UNITS	TEST CONDITIONS
		MIN	TYP	MAX		
$t_{PLH}$ $t_{PHL}$	Propagation Delay, P to $\overline{P} = \overline{Q}$		30 20	45 30	ns	$V_{CC} = 5.0\text{ V}$ $C_L = 45\text{ pF}$ $R_L = 667\ \Omega$
$t_{PLH}$ $t_{PHL}$	Propagation Delay, Q to $\overline{P} = \overline{Q}$		24 23	35 35	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay, P to $\overline{P} > \overline{Q}$		31 17	45 30	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay, Q to $\overline{P} > \overline{Q}$		30 21	45 30	ns	

**SN54LS/74LS684**

SYMBOL	PARAMETER	LIMITS			UNITS	TEST CONDITIONS
		MIN	TYP	MAX		
$t_{PLH}$ $t_{PHL}$	Propagation Delay, P to $\overline{P} = \overline{Q}$		15 17	25 25	ns	$V_{CC} = 5.0\text{ V}$ $C_L = 45\text{ pF}$ $R_L = 667\ \Omega$
$t_{PLH}$ $t_{PHL}$	Propagation Delay, Q to $\overline{P} = \overline{Q}$		16 15	25 25	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay, P to $\overline{P} > \overline{Q}$		22 17	30 30	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay, Q to $\overline{P} > \overline{Q}$		24 20	30 30	ns	

**SN54LS/74LS685**

SYMBOL	PARAMETER	LIMITS			UNITS	TEST CONDITIONS
		MIN	TYP	MAX		
$t_{PLH}$ $t_{PHL}$	Propagation Delay, P to $\overline{P} = \overline{Q}$		30 19	45 35	ns	$V_{CC} = 5.0\text{ V}$ $C_L = 45\text{ pF}$ $R_L = 667\ \Omega$
$t_{PLH}$ $t_{PHL}$	Propagation Delay, Q to $\overline{P} = \overline{Q}$		24 23	45 35	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay, P to $\overline{P} > \overline{Q}$		32 16	45 35	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay, Q to $\overline{P} > \overline{Q}$		30 20	45 35	ns	

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**SN54LS/74LS686 • SN54LS/74LS687**  
**SN54LS/74LS688 • SN54LS/74LS689**

**AC CHARACTERISTICS:**  $T_A = 25^\circ\text{C}$

**SN54LS/74LS686**

SYMBOL	PARAMETER	LIMITS			UNITS	TEST CONDITIONS
		MIN	TYP	MAX		
$t_{PLH}$ $t_{PHL}$	Propagation Delay, P to $\overline{P=Q}$		13 20	25 30	ns	$V_{CC} = 5.0\text{ V}$ $C_L = 45\text{ pF}$ $R_L = 667\ \Omega$
$t_{PLH}$ $t_{PHL}$	Propagation Delay, Q to $\overline{P=Q}$		13 21	25 30	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay, $\overline{G}, \overline{G1}$ to $\overline{P=Q}$		11 19	20 30	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay, P to $\overline{P>Q}$		19 15	30 30	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay, Q to $\overline{P>Q}$		18 19	30 30	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay, $\overline{G2}$ to $\overline{P>Q}$		21 16	30 25	ns	

**SN54LS/74LS687**

SYMBOL	PARAMETER	LIMITS			UNITS	TEST CONDITIONS
		MIN	TYP	MAX		
$t_{PLH}$ $t_{PHL}$	Propagation Delay, P to $\overline{P=Q}$		24 20	35 30	ns	$V_{CC} = 5.0\text{ V}$ $C_L = 45\text{ pF}$ $R_L = 667\ \Omega$
$t_{PLH}$ $t_{PHL}$	Propagation Delay, Q to $\overline{P=Q}$		24 20	35 30	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay, $\overline{G}, \overline{G1}$ to $\overline{P=Q}$		21 18	35 30	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay, P to $\overline{P>Q}$		24 16	35 30	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay, Q to $\overline{P>Q}$		24 16	35 30	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay, $\overline{G2}$ to $\overline{P>Q}$		24 15	35 30	ns	

**SN54LS/74LS688**

SYMBOL	PARAMETER	LIMITS			UNITS	TEST CONDITIONS
		MIN	TYP	MAX		
$t_{PLH}$ $t_{PHL}$	Propagation Delay, P to $\overline{P=Q}$		12 17	18 23	ns	$V_{CC} = 5.0\text{ V}$ $C_L = 45\text{ pF}$ $R_L = 667\ \Omega$
$t_{PLH}$ $t_{PHL}$	Propagation Delay, Q to $\overline{P=Q}$		12 17	18 23	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay, $\overline{G}, \overline{G1}$ to $\overline{P=Q}$		12 13	18 20	ns	

**SN54LS/74LS689**

SYMBOL	PARAMETER	LIMITS			UNITS	TEST CONDITIONS
		MIN	TYP	MAX		
$t_{PLH}$ $t_{PHL}$	Propagation Delay, P to $\overline{P=Q}$		24 22	40 35	ns	$V_{CC} = 5.0\text{ V}$ $C_L = 45\text{ pF}$ $R_L = 667\ \Omega$
$t_{PLH}$ $t_{PHL}$	Propagation Delay, Q to $\overline{P=Q}$		24 22	40 35	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay, $\overline{G}, \overline{G1}$ to $\overline{P=Q}$		22 19	35 30	ns	