MOTOROLA

SN54LS/74LS682 thru SN54LS/74LS689

8-BIT MAGNITUDE COMPARATORS

LOW POWER SCHOTTKY

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.

TYPE	$\overline{P=Q}$	$\overline{P>Q}$	OUTPUT ENABLE	OUTPUT CONFIGURATION	PULLUP
LS682	yes	yes	no	totem-pole	yes
LS683	yes	yes	no	open-collector	yes
LS684	yes	yes	no	totem-pole	no
LS685	yes	yes	no	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

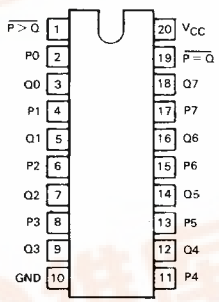
FUNCTION TABLE

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

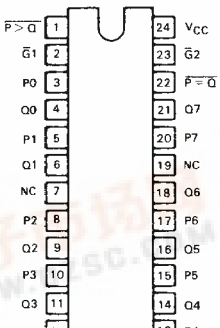
CONNECTION DIAGRAMS
(TOP VIEW)

SN54LS/74LS682 THRU SN54LS/74LS685



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

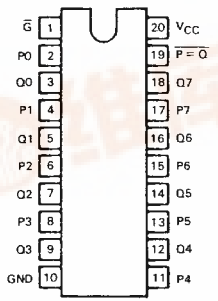
SN54LS/74LS686 SN54LS/74LS687



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)

5

GUARANTEED OPERATING RANGES

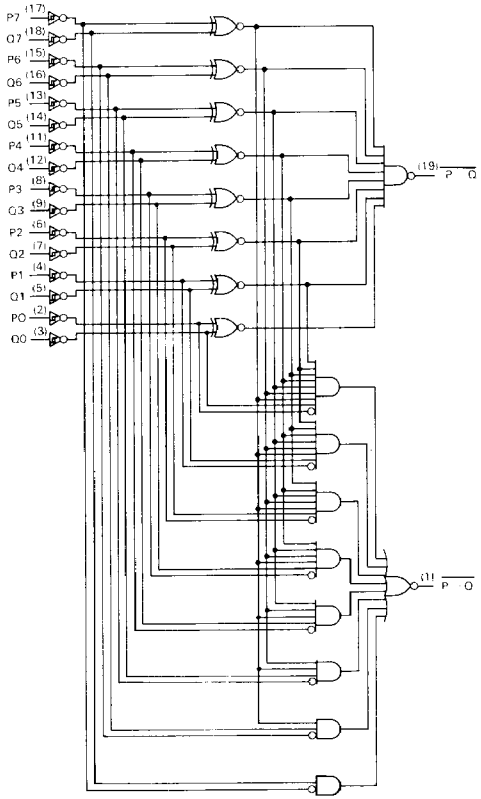
SYMBOL	PARAMETER		MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	54 74	4.5 4.75	5.0 5.0	5.5 5.25	V
T_A	Operating Ambient Temperature Range	54 74	−55 0	25 25	125 70	°C
I_{OH}	Output Current — High	54,74			−0.4	mA
I_{OL}	Output Current — Low	54 74			12 24	mA

DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

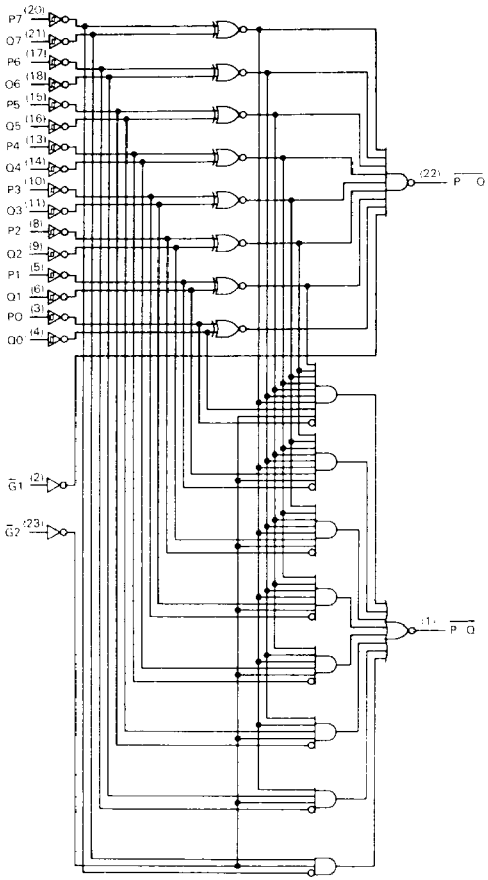
SYMBOL	PARAMETER		LIMITS MIN	LIMITS TYP	LIMITS MAX	UNITS	TEST CONDITIONS
V_{IH}	Input HIGH Voltage		2.0			V	Guaranteed Input HIGH Voltage for All Inputs
V_{IL}	Input LOW Voltage	54			0.7	V	Guaranteed Input LOW Voltage for All Inputs
		74			0.8		
V_{IK}	Input Clamp Diode Voltage			−0.65	−1.5	V	V_{CC} = 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
		LS682-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		−30		−130	mA	V_{CC} = MAX
I_{CC}	Power Supply Current	LS682			70	mA	V_{CC} = MAX
		LS684			65	mA	
		LS686			75	mA	
		LS688			65	mA	

5

BLOCK DIAGRAMS



SN54LS/74LS682 thru LS685



SN54LS/74LS686, LS687

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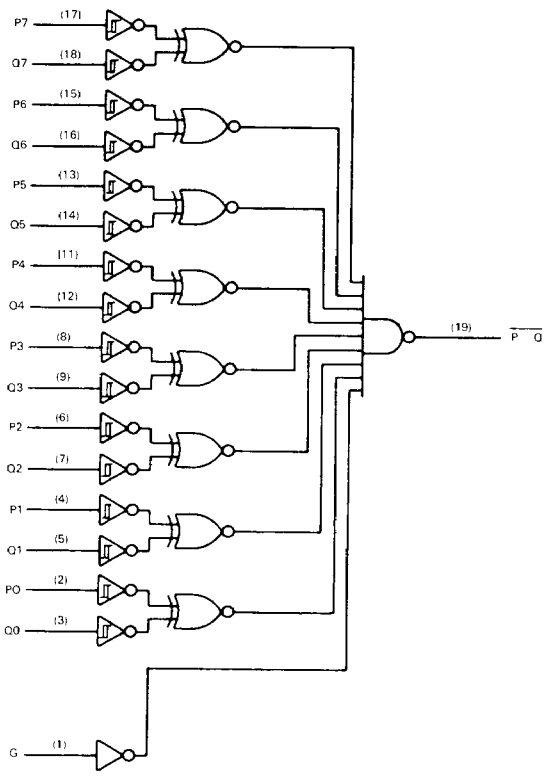
BLOCK DIAGRAM



SN54LS/74LS688, LS689

GUARANTEED OPERATING RANGES

SYMBOL	PARAMETER		MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	54 74	4.5 4.75	5.0 5.0	5.5 5.25	V
T_A	Operating Ambient Temperature Range	54 74	−55 0	25 25	125 70	°C
V_{OH}	Output Voltage — High	54,74			5.5	V
I_{OL}	Output Current — Low	54 74			12 24	mA

DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

SYMBOL	PARAMETER		LIMITS MIN	LIMITS TYP	LIMITS MAX	UNITS	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
I_{OH}	Output HIGH Current	54			250	μA	V_{CC} = MIN, V_{OH} = MAX
		74			100	μA	
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_{CC} = V_{CC} MIN, V_{IN} = V_{IL} or V_{IH} per Truth Table
I_{IH}	Input HIGH Current				20	μA	V_{CC} = MAX, V_{IN} = 2.7 V
		LS683-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	LS683-Q Inputs			−0.4	mA	V_{CC} = MAX, V_{IN} = 0.4 V
		Others			−0.2	mA	
I_{CC}	Power Supply Current	LS683			70	mA	V_{CC} = MAX
		LS685			65	mA	
		LS687			75	mA	
		LS689			65	mA	

5

AC CHARACTERISTICS: $T_A = 25°C$

SN54LS/74LS682

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

SN54LS/74LS683

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

SN54LS/74LS684

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

SN54LS/74LS685

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

AC CHARACTERISTICS: $T_A = 25°C$

SN54LS/74LS686

SYMBOL	PARAMETER	LIMITS MIN	LIMITS TYP	LIMITS MAX	UNITS	TEST CONDITIONS
t_{PLH} t_{PHL}	Propagation Delay, P to $\overline{P = Q}$		13 20	25 30	ns	$V_{CC} = 5.0$ V $C_L = 45$ 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 MIN	LIMITS TYP	LIMITS MAX	UNITS	TEST CONDITIONS
t_{PLH} t_{PHL}	Propagation Delay, P to $\overline{P = Q}$		24 20	35 30	ns	$V_{CC} = 5.0$ V $C_L = 45$ 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 MIN	LIMITS TYP	LIMITS MAX	UNITS	TEST CONDITIONS
t_{PLH} t_{PHL}	Propagation Delay, P to $\overline{P = Q}$		12 17	18 23	ns	$V_{CC} = 5.0$ V $C_L = 45$ 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 MIN	LIMITS TYP	LIMITS MAX	UNITS	TEST CONDITIONS
t_{PLH} t_{PHL}	Propagation Delay, P to $\overline{P = Q}$		24 22	40 35	ns	$V_{CC} = 5.0$ V $C_L = 45$ 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	

5