

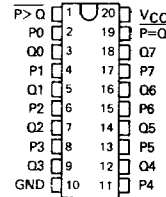
TYPES SN54LS682 THRU SN54LS689, SN74LS682 THRU SN74LS689 8-BIT MAGNITUDE/IDENTITY COMPARATORS

D2617, JANUARY 1981—REVISED DECEMBER 1983

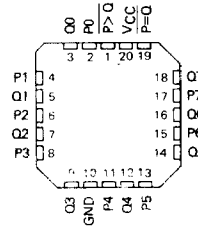
- Compares Two 8-Bit Words
- Choice of Totem-Pole or Open-Collector Outputs
- Hysteresis at P and Q Inputs
- 'LS682 and 'LS683 have 20-k Ω Pullup Resistors on the Q Inputs
- 'LS686 and 'LS687 . . . New JT and NT 24-Pin, 3000-Mil Packages

TYPE	P = Q	P > Q	OUTPUT		20-k Ω PULLUP
			ENABLE	CONFIGURATION	
'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

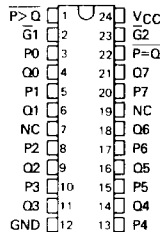
SN54LS682 THRU SN54LS685 . . . J PACKAGE
SN74LS682 THRU SN74LS685 . . . DW, J OR N PACKAGE
(TOP VIEW)



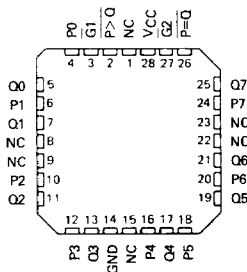
SN54LS682 THRU SN54LS685 . . . FK PACKAGE
SN74LS682 THRU SN74LS685 . . . FN PACKAGE
(TOP VIEW)



SN54LS686, SN54LS687 . . . JT PACKAGE
SN74LS686, SN74LS687 . . . DW, JT OR NT PACKAGE
(TOP VIEW)

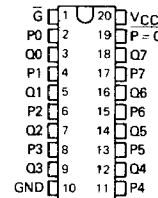


SN54LS686, SN54LS687 . . . FK PACKAGE
SN74LS686, SN74LS687 . . . FN PACKAGE
(TOP VIEW)

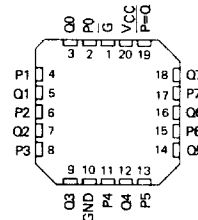


NC - No internal connection

SN54LS688, SN54LS689 . . . J PACKAGE
SN74LS688, SN74LS689 . . . DW, J OR N PACKAGE
(TOP VIEW)



SN54LS688, SN54LS689 . . . FK PACKAGE
SN74LS688, SN74LS689 . . . FN PACKAGE
(TOP VIEW)



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PRODUCTION DATA
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3-1295

TYPES SN54LS682 THRU SN54LS689, SN74LS682 THRU SN74LS689 8-BIT MAGNITUDE/IDENTITY COMPARATORS

description

These magnitude comparators perform comparisons of two eight-bit binary or BCD words. All types provide $\overline{P = Q}$ outputs and the 'LS682 thru 'LS687 provide $\overline{P > Q}$ outputs as well. The 'LS682, 'LS684, 'LS686, and 'LS688 have totem-pole outputs, while the 'LS683, 'LS685, 'LS687, and 'LS689 have open-collector outputs. The 'LS682 and 'LS683 feature 20-k Ω pullup termination resistors on the Q inputs for analog or switch data.

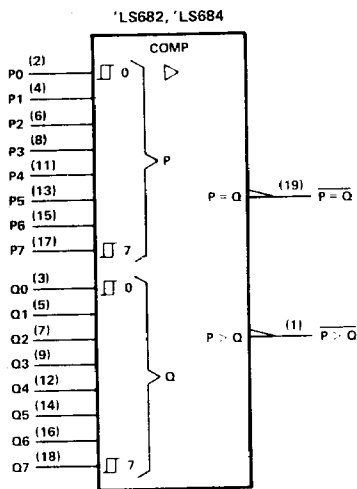
FUNCTION TABLE

DATA P, Q	ENABLES		OUTPUTS	
	$\overline{G}, \overline{G1}$	$\overline{G2}$	$\overline{P = Q}$	$\overline{P > Q}$
P = Q	L	X	L	H
P > Q	X	L	H	L
P < Q	X	X	H	H
P = Q	H	X	H	H
P > Q	X	H	H	H
X	H	H	H	H

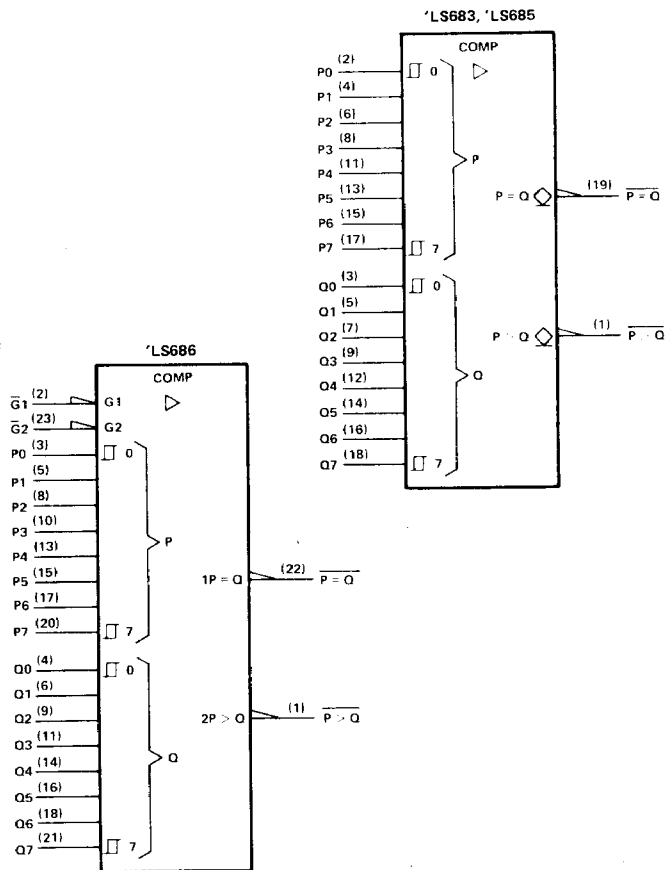
- NOTES: 1. The last three lines of the function table applies only to the devices having enable inputs, i.e., 'LS686 thru 'LS689.
2. The $\overline{P < Q}$ function can be generated by applying the $\overline{P = Q}$ and $\overline{P > Q}$ outputs to a 2-input NAND gate.
3. For 'LS686, 'LS687 G1 enables $\overline{P = Q}$, and G2 enables $\overline{P > Q}$.

logic symbols

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TTL DEVICES

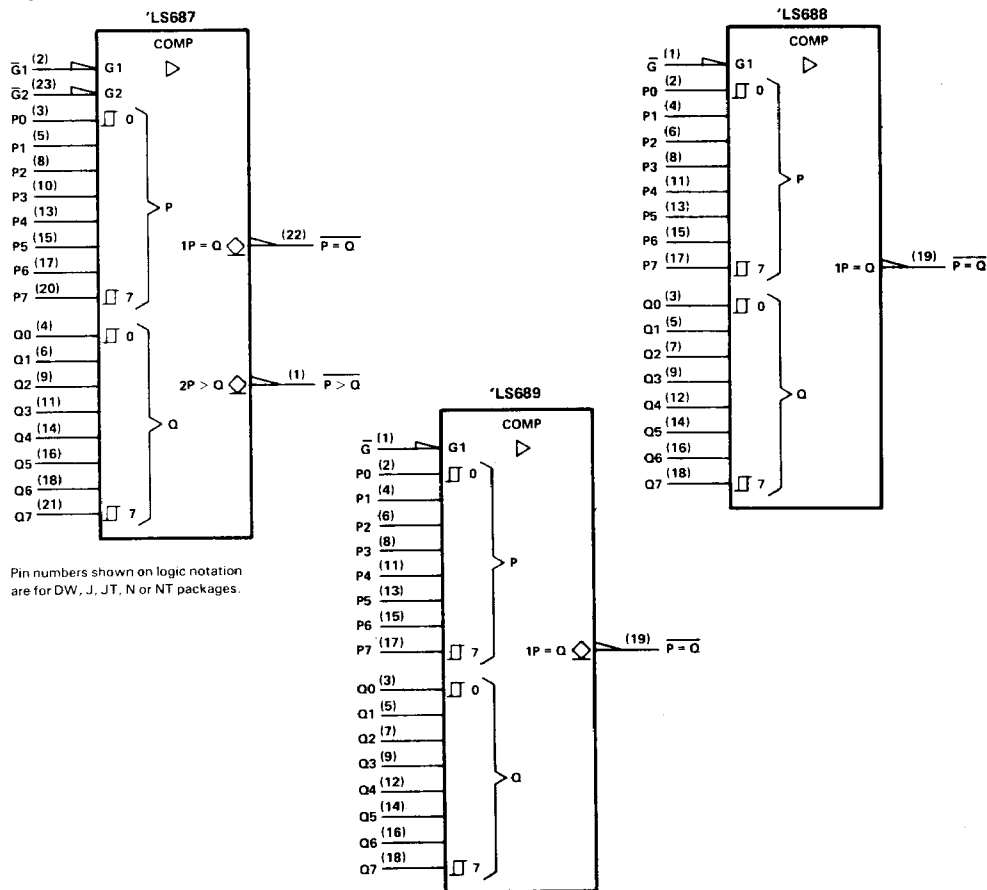


Pin numbers shown on logic notation are for DW, J, JT, N or NT packages.



TYPES SN54LS682 THRU SN54LS689, SN74LS682 THRU SN74LS689 8-BIT MAGNITUDE/IDENTITY COMPARATORS

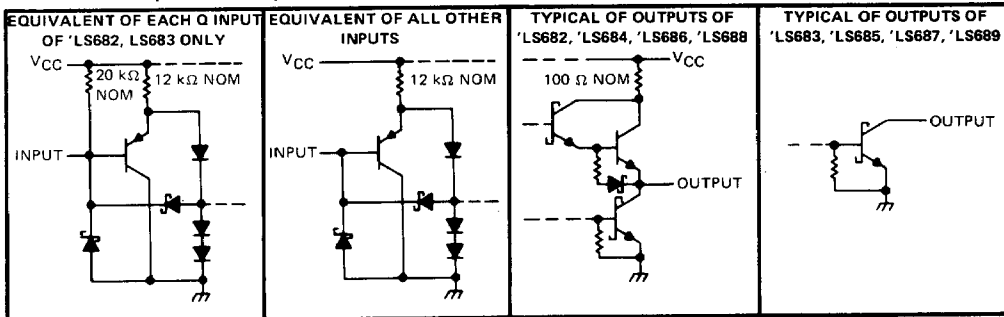
logic symbols (continued)



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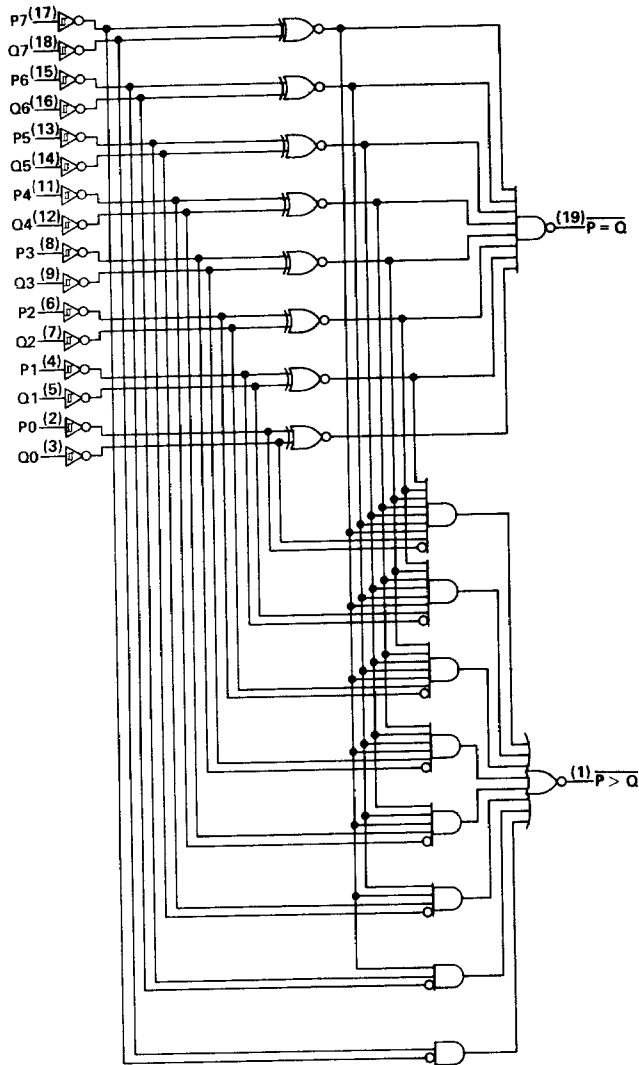
TTL DEVICES

schematics of inputs and outputs



**TYPES SN54LS682 THRU SN54LS685
SN74LS682 THRU SN74LS685
8-BIT MAGNITUDE/IDENTITY COMPARATORS**

'LS682 thru 'LS685 logic diagram (positive logic)



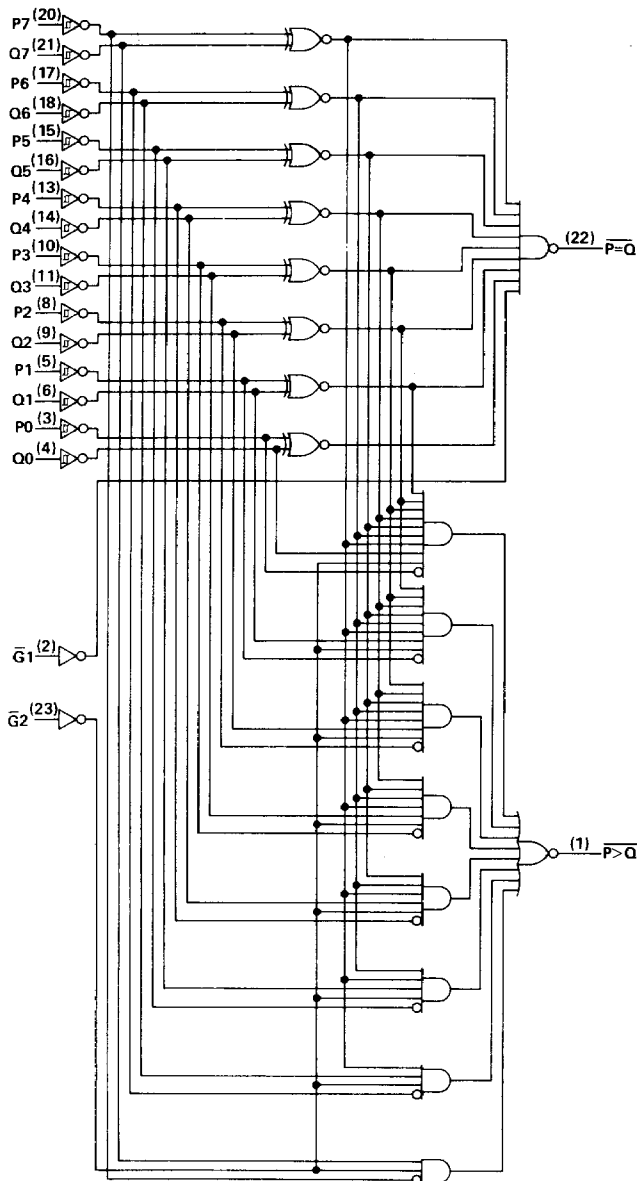
Pin numbers shown on logic notation are for DW, J or N packages



TTL DEVICES

TYPES SN54LS686, SN54LS687
 SN74LS686, SN74LS687
 8-BIT MAGNITUDE/IDENTITY COMPARATORS

'LS686, 'LS687 logic diagram (positive logic)

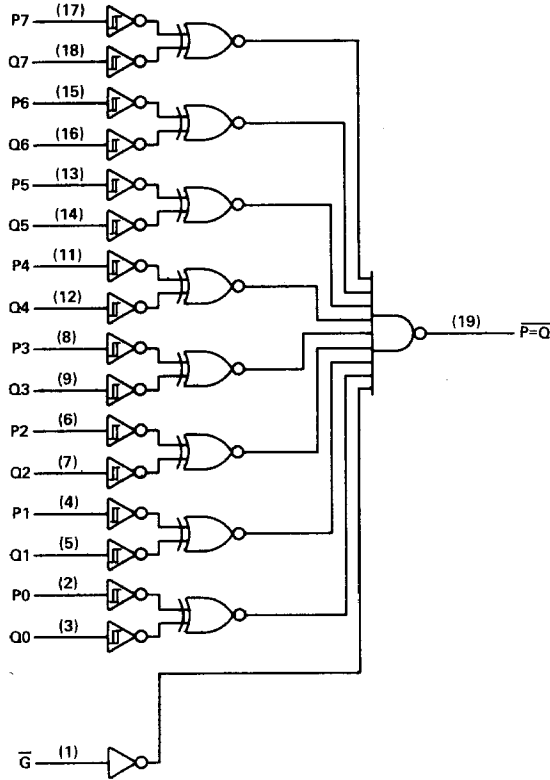


Pin numbers shown on logic notation are for DW, JT, or NT packages.

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**TYPES SN54LS688, SN54LS689,
SN74LS688, SN74LS689
8-BIT IDENTITY COMPARATORS**

'LS688, 'LS689 logic diagram (positive logic)



Pin numbers shown on logic notation are for DW, J or N packages.

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TTL DEVICES

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

Supply voltage (see Note 1)	7 V
Input voltage: Q inputs of 'LS682 and 'LS683	5.5 V
All other inputs	7 V
Off-state output voltage: 'LS683, 'LS685, 'LS687, 'LS689	7 V
Operating free-air temperature range: SN54LS682 thru SN54LS689	-55°C to 125°C
SN74LS682 thru SN74LS689	0°C to 70°C
Storage temperature range	-65°C to 150°C

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

**TYPES SN54LS682, SN54LS684, SN54LS686, SN54LS688,
SN74LS682, SN74LS684, SN74LS686, SN74LS688
8-BIT MAGNITUDE/IDENTITY COMPARATORS WITH TOTEM-POLE OUTPUTS**

'LS682, 'LS684, 'LS686, 'LS688

recommended operating conditions

	SN54LS'			SN74LS'			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}			-400			-400	μ A
Low-level output current, I_{OL}			12			24	mA
Operating free-air temperature, T_A	-55		125	0		70	$^{\circ}$ 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_{IH}	High-level input voltage	2			2			V	
V_{IL}	Low-level input voltage			0.7			0.8	V	
$V_{T+} - V_{T-}$	Hysteresis P or Q inputs	V _{CC} = MIN		0.4	0.4			V	
V_{IK}	Input clamp voltage	V _{CC} = MIN, $I_I = -18$ mA		-1.5	-1.5			V	
V_{OH}	High-level output voltage	V _{CC} = MIN, $V_{IH} = 2$ V, $V_{IL} = V_{ILmax}$, $I_{OH} = -400$ μ A		2.5	2.7			V	
V_{OL}	Low-level output voltage	V _{CC} = MIN, $V_{IH} = 2$ V, $V_{IL} = V_{ILmax}$		$I_{OL} = 12$ mA	0.25	0.4	0.25	0.4	V
				$I_{OL} = 24$ mA			0.35	0.5	
I_I	Input current at maximum input voltage	Q inputs, 'LS682	V _{CC} = MAX, $V_I = 5.5$ V						mA
		All other inputs	V _{CC} = MAX, $V_I = 7$ V						
I_{IH}	High-level input current	V _{CC} = MAX, $V_I = 2.7$ V		20		20		μ A	
I_{IL}	Low-level input current	Q inputs, 'LS682	V _{CC} = MAX, $V_I = 0.4$ V		-0.4		-0.4		mA
		All other inputs			-0.2		-0.2		
$I_{OS} §$	Short-circuit output current	V _{CC} = MAX, $V_O = 0$		-20	-100	-20	-100	mA	
I_{CC}	Supply current	'LS682	V _{CC} = MAX, See Note 2		42	70	42	70	mA
		'LS684			40	65	40	65	
		'LS686			44	75	44	75	
		'LS688			40	65	40	65	

‡ All typical values are at $V_{CC} = 5$ V, $T_A = 25^{\circ}$ C.

§ Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.

NOTE 2: I_{CC} is measured with any \bar{G} inputs grounded, all other inputs at 4.5 V, and all outputs open.

switching characteristics, $V_{CC} = 5$ V, $T_A = 25^{\circ}$ C

PARAMETER#	FROM (INPUTS)	TO (OUTPUT)	TEST CONDITIONS	'LS682				'LS684				'LS686				'LS688				UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX		
t_{PLH}	P	$\bar{P} = \bar{Q}$	$R_L = 667 \Omega$, $C_L = 45$ pF, All other inputs low, See Note 3	13	25		15	25		13	25		18	27					ns	
				15	25		17	25		20	30		20	30		30				
t_{PLH}	Q	$\bar{P} = \bar{Q}$		14	25		16	25		13	25		18	27					ns	
				15	25		15	25		21	30		20	30		30				
t_{PHL}	$\bar{G}, \bar{G}1$	$\bar{P} = \bar{Q}$								11	20		12	18					ns	
										19	30		13	20						
t_{PLH}	P	$\bar{P} > \bar{Q}$			20	30		22	30		19	30							ns	
					15	30		17	30		15	30								
t_{PLH}	Q	$\bar{P} > \bar{Q}$			21	30		24	30		18	30							ns	
					19	30		20	30		19	30								
t_{PHL}	$\bar{G}2$	$\bar{P} > \bar{Q}$							21	30								ns		
									16	25										

t_{PLH} \equiv propagation delay time, low-to-high-level outputs; t_{PHL} \equiv propagation delay time, high-to-low-level output.

NOTE 3: See General Information Section for load circuits and voltage waveforms.

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TTL DEVICES



**TYPES SN54LS683, SN54LS685, SN54LS687, SN54LS689,
SN74LS683, SN74LS685, SN74LS687, SN74LS689
8-BIT MAGNITUDE/IDENTITY COMPARATORS WITH OPEN-COLLECTOR OUTPUTS**

recommended operating conditions 'LS683, 'LS685, 'LS687, 'LS689

	SN54LS'			SN74LS'			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 voltage, V_{OH}	5.5			5.5			V
Low-level output current, I_{OL}	12			24			mA
Operating free-air temperature, T_A	-55			125			°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_{IH}	High-level input voltage		2			2			V
V_{IL}	Low-level input voltage		0.7			0.8			V
$V_{T+} - V_{T-}$	Hysteresis	P or Q inputs	0.4			0.4			V
V_{IK}	Input clamp voltage	$V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$	-1.5			-1.5			V
I_{OH}	High-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL\text{max}}, V_{OH} = 5.5 \text{ V}$	250			100			μA
V_{OL}	Low-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL\text{max}}$	$I_{OL} = 12 \text{ mA}$			$I_{OL} = 24 \text{ mA}$			V
I_I	Input current at maximum input voltage	Q inputs, 'LS683	$V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$			0.1			mA
		All other inputs	$V_{CC} = \text{MAX}, V_I = 7 \text{ V}$						
I_{IH}	High-level input current	$V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$	20			20			μA
I_{IL}	Low-level input current	Q inputs, 'LS683	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$			-0.4			mA
		All other inputs				-0.2			
I_{CC}	Supply current	'LS683	42			70			mA
		'LS685	40			65			
		'LS687	44			75			
		'LS689	40			65			

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at $V_{CC} = 5 \text{ V}, T_A = 25^\circ \text{C}$.

NOTE 2: I_{CC} is measured with any \bar{G} inputs grounded, all other inputs at 4.5 V, and all outputs open.

switching characteristics, $V_{CC} = 5 \text{ V}, T_A = 25^\circ \text{C}$

PARAMETER†	FROM (INPUTS)	TO (OUTPUT)	TEST CONDITIONS	'LS683		'LS685		'LS687		'LS689		UNIT
				MIN	TYP MAX	MIN	TYP MAX	MIN	TYP MAX	MIN	TYP MAX	
t_{PLH}	P	$\bar{P} = \bar{Q}$	$R_L = 667 \Omega, C_L = 45 \text{ pF},$ All other inputs low, See Note 3	30	45	30	45	24	35	24	40	ns
t_{PHL}				20	30	19	35	20	30	22	35	
t_{PLH}	Q	$\bar{P} = \bar{Q}$		24	35	24	45	24	35	24	40	ns
t_{PHL}				23	35	23	35	20	30	22	35	
t_{PLH}	$\bar{G}, \bar{G}1$	$\bar{P} = \bar{Q}$						21	35	22	35	ns
t_{PHL}								18	30	19	30	
t_{PLH}	P	$\bar{P} > \bar{Q}$		31	45	32	45	24	35			ns
t_{PHL}				17	30	16	35	16	30			
t_{PLH}	Q	$\bar{P} > \bar{Q}$		30	45	30	45	24	35			ns
t_{PHL}				21	30	20	35	16	30			
t_{PLH}	$\bar{G}2$	$\bar{P} > \bar{Q}$					24	35			ns	
t_{PHL}							15	30				

† t_{PLH} = propagation delay time, low-to-high-level output; t_{PHL} = propagation delay time, high-to-low-level output.
NOTE 3: See General Information Section for load circuits and voltage waveforms.

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