

# TC74HCT688AP, TC74HCT688AF

## 8-Bit Equality Comparator

The TC74HCT688A is a high speed CMOS 8-BIT EQUALITY COMPARATOR fabricated with silicon gate C<sup>2</sup>MOS technology.

It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

This device may be used as a level converter for interfacing TTL or NMOS to High Speed CMOS. The inputs are compatible with TTL, NMOS and CMOS output voltage levels.

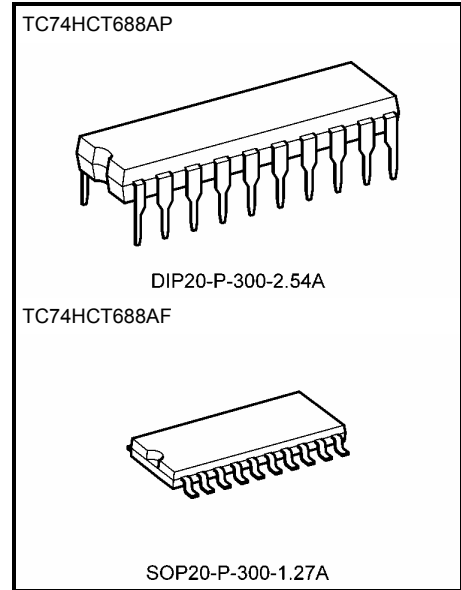
The TC74HCT688A compares two 8-bit binary or BCD words applied inputs P<sub>0</sub>~P<sub>7</sub>, and inputs Q<sub>0</sub>~Q<sub>7</sub>, and indicates whether or not they are equal.

A signal active low enable is provided to facilitate cascading of several packages to compare of words greater than 8 bits.

All inputs are equipped with protection circuits against static discharge or transient excess voltage.

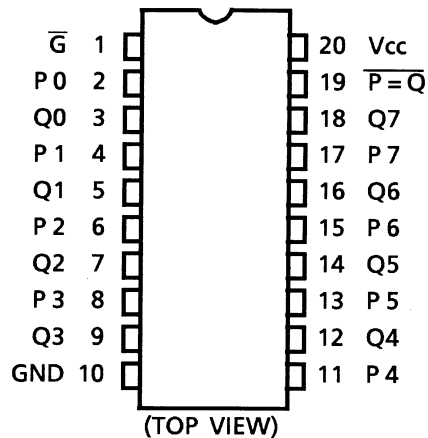
### Features

- High speed:  $t_{pd} = 17 \text{ ns (typ.)}$  at  $V_{CC} = 5 \text{ V}$
- Low power dissipation:  $I_{CC} = 4 \mu\text{A (max)}$  at  $T_a = 25^\circ\text{C}$
- Compatible with TTL outputs:  $V_{IH} = 2.0 \text{ V (min)}$   
 $V_{IL} = 0.8 \text{ V (max)}$
- Output drive capability: 10 LSTTL loads
- Symmetrical output impedance:  $|I_{OH}| = I_{OL} = 4 \text{ mA (min)}$
- Balanced propagation delays:  $t_{pLH} \approx t_{pHL}$
- Pin and function compatible with 74LS688

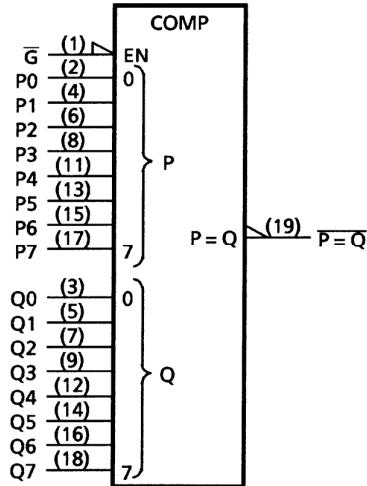


Weight	
DIP20-P-300-2.54A	: 1.30 g (typ.)
SOP20-P-300-1.27A	: 0.22 g (typ.)

### Pin Assignment



## IEC Logic Symbol

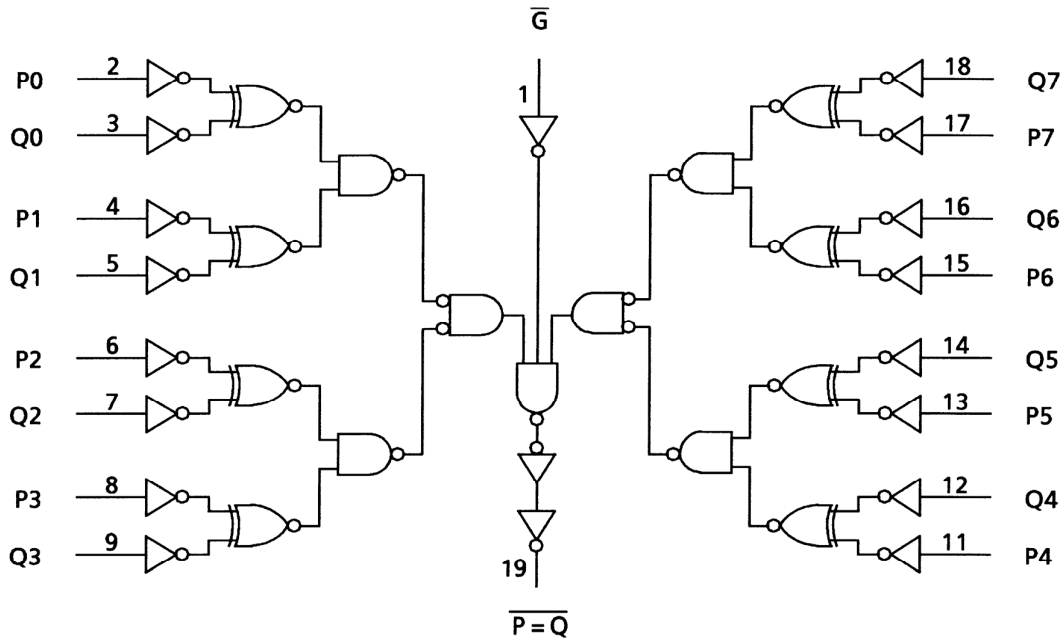


## Truth Table

Inputs		Output
P, Q	$\overline{G}$	$\overline{P=Q}$
P = Q	L	L
P ≠ Q	L	H
X	H	H

X: Don't care

## System Diagram



## Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V <sub>CC</sub>	-0.5~7.0	V
DC input voltage	V <sub>IN</sub>	-0.5~V <sub>CC</sub> + 0.5	V
DC output voltage	V <sub>OUT</sub>	-0.5~V <sub>CC</sub> + 0.5	V
Input diode current	I <sub>IK</sub>	±20	mA
Output diode current	I <sub>OK</sub>	±20	mA
DC output current	I <sub>OUT</sub>	±25	mA
DC V <sub>CC</sub> /ground current	I <sub>CC</sub>	±50	mA
Power dissipation	P <sub>D</sub>	500 (DIP) (Note 2)/180 (SOP)	mW
Storage temperature	T <sub>stg</sub>	-65~150	°C

Note 1: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 2: 500 mW in the range of Ta = -40 to 65°C. From Ta = 65 to 85°C a derating factor of -10 mW/°C should be applied up to 300 mW.

## Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	4.5~5.5	V
Input voltage	V <sub>IN</sub>	0~V <sub>CC</sub>	V
Output voltage	V <sub>OUT</sub>	0~V <sub>CC</sub>	V
Operating temperature	T <sub>opr</sub>	-40~85	°C
Input rise and fall time	t <sub>r</sub> , t <sub>f</sub>	0~500	ns

Note: The operating ranges must be maintained to ensure the normal operation of the device. Unused inputs must be tied to either V<sub>CC</sub> or GND.

## Electrical Characteristics

### DC Characteristics

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40~85°C		Unit		
			V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max	
High-level input voltage	V <sub>IH</sub>	—	4.5~5.5	2.0	—	—	2.0	—	V	
Low-level input voltage	V <sub>IL</sub>	—	4.5~5.5	—	—	0.8	—	0.8	V	
High-level output voltage	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -20 μA	4.5	4.4	4.5	—	4.4	—	V
			I <sub>OH</sub> = -4 mA	4.5	4.18	4.31	—	4.13	—	
Low-level output voltage	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 20 μA	4.5	—	0.0	0.1	—	0.1	V
			I <sub>OL</sub> = 4 mA	4.5	—	0.17	0.26	—	0.33	
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5	—	—	±0.1	—	±1.0	μA	
Quiescent supply current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5	—	—	4.0	—	40.0	μA	
	I <sub>c</sub>	Per input: V <sub>IN</sub> = 0.5 V or 2.4 V Other input: V <sub>CC</sub> or GND	5.5	—	—	2.0	—	2.9	mA	

### AC Characteristics ( $C_L = 15 \text{ pF}$ , $V_{CC} = 5 \text{ V}$ , $T_a = 25^\circ\text{C}$ , input: $t_r = t_f = 6 \text{ ns}$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Output transition time	$t_{TLH}$	—	—	6	12	ns
	$t_{THL}$					
Propagation delay time ( $P_n, Q_n - \overline{P} = \overline{Q}$ )	$t_{pLH}$	—	—	17	27	ns
	$t_{pHL}$					
Propagation delay time ( $\overline{G} - \overline{P} = \overline{Q}$ )	$t_{pLH}$	—	—	12	19	ns
	$t_{pHL}$					

### AC Characteristics ( $C_L = 50 \text{ pF}$ , input: $t_r = t_f = 6 \text{ ns}$ )

Characteristics	Symbol	Test Condition	$T_a = 25^\circ\text{C}$			$T_a = -40 \sim 85^\circ\text{C}$		Unit	
			$V_{CC} \text{ (V)}$	Min	Typ.	Max	Min		Max
Output transition time	$t_{TLH}$	—	4.5	—	8	15	—	19	ns
	$t_{THL}$		5.5	—	7	13	—	16	
Propagation delay time ( $P_n, Q_n - \overline{P} = \overline{Q}$ )	$t_{pLH}$	—	4.5	—	21	32	—	40	ns
	$t_{pHL}$		5.5	—	18	29	—	36	
Propagation delay time ( $\overline{G} - \overline{P} = \overline{Q}$ )	$t_{pLH}$	—	4.5	—	15	23	—	29	ns
	$t_{pHL}$		5.5	—	13	21	—	26	
Input capacitance	$C_{IN}$	—	—	5	10	—	10	pF	
Power dissipation capacitance	$C_{PD}$ (Note)	—	—	32	—	—	—	pF	

Note:  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:

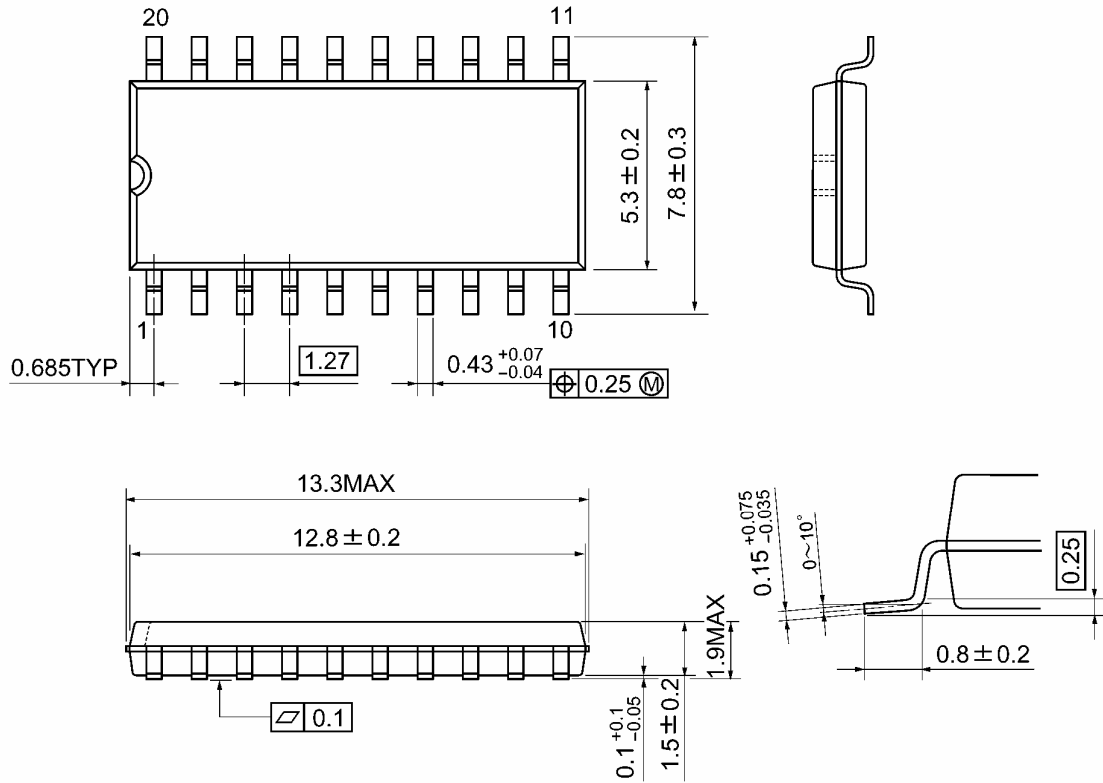
$$I_{CC} (\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$



## Package Dimensions

SOP20-P-300-1.27A

Unit: mm



Weight: 0.22 g (typ.)

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20070701-EN GENERAL

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