

TC74HCT688AP, TC74HCT688AF

8-Bit Equality Comparator

The TC74HCT688A is a high speed CMOS 8-BIT EQUALITY COMPARATOR fabricated with silicon gate C²MOS 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 P₀~P₇, and inputs Q₀~Q₇, and indicates whether or not they are equal.

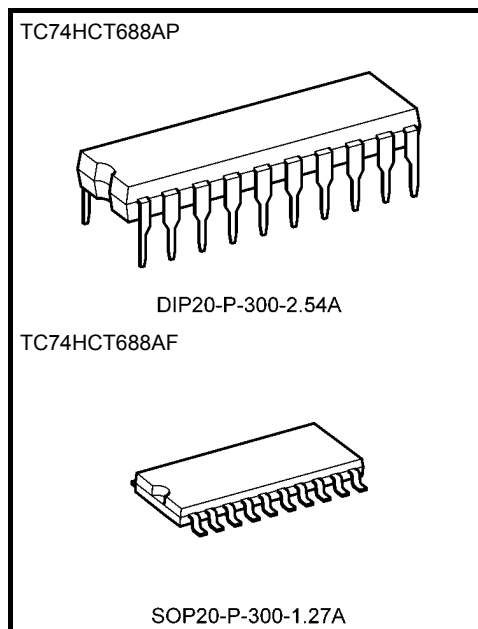
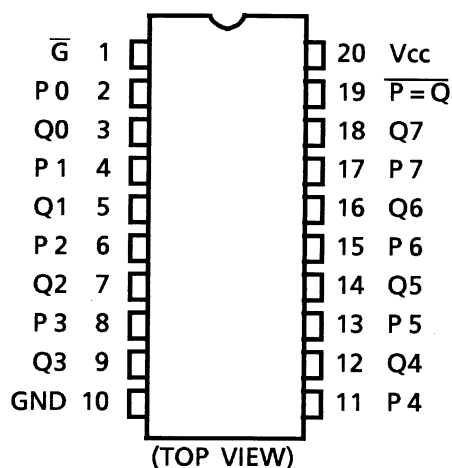
A signal active low enable is provided to facilitate cascading of several package to compare of words greater than 8 bits.

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

Features

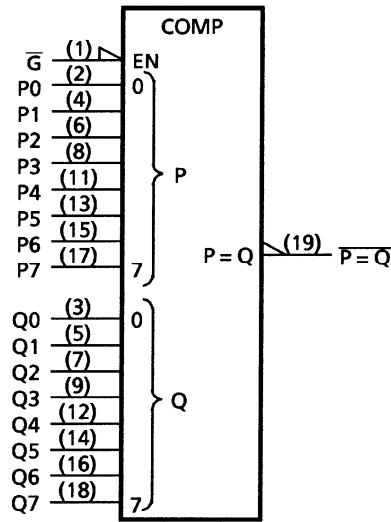
- High speed: $t_{pd} = 17 \text{ ns (typ.)}$ at $V_{CC} = 5 \text{ V}$
- Low power dissipation: $I_{CC} = 4 \mu\text{A (max)}$ at $T_a = 25^\circ\text{C}$
- Compatible with TTL outputs: $V_{IH} = 2.0 \text{ V (min)}$
 $V_{IL} = 0.8 \text{ V (max)}$
- Output drive capability: 10 LSTTL loads
- Symmetrical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

Pin Assignment



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

IEC Logic Symbol

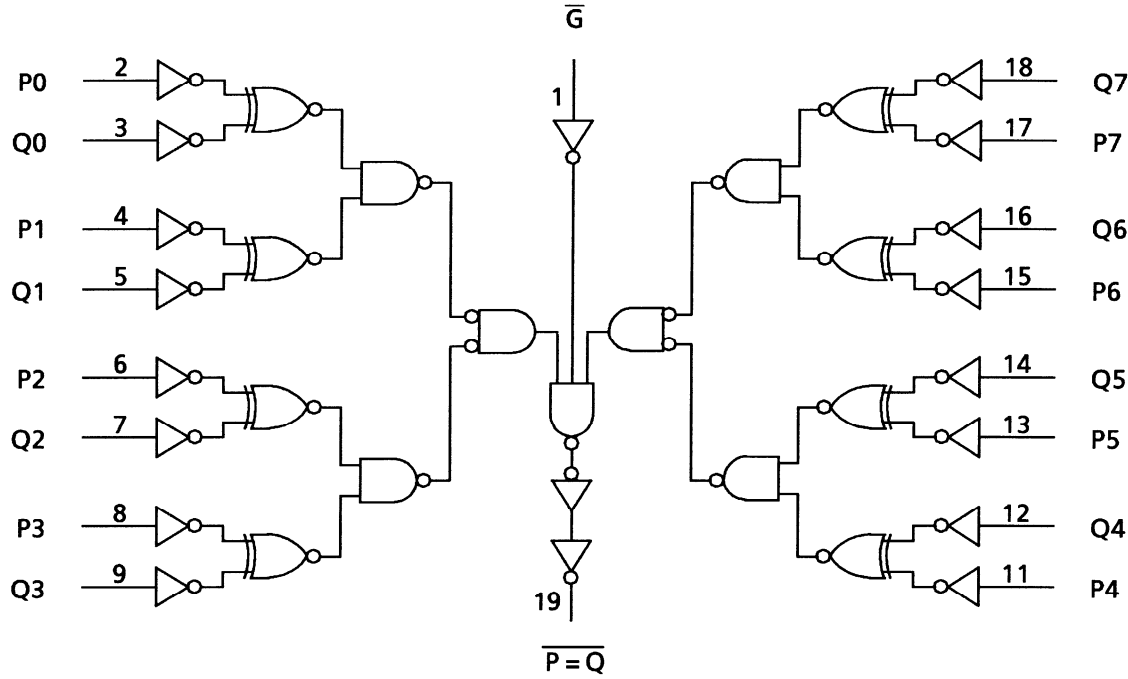


Truth Table

Inputs		Output
P, Q	$\overline{G}$	$\overline{P=Q}$
P = Q	L	L
P $\neq$ 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_{CC}	$-0.5 \sim 7.0$	V
DC input voltage	V_{IN}	$-0.5 \sim V_{CC} + 0.5$	V
DC output voltage	V_{OUT}	$-0.5 \sim V_{CC} + 0.5$	V
Input diode current	I_{IK}	± 20	mA
Output diode current	I_{OK}	± 20	mA
DC output current	I_{OUT}	± 25	mA
DC V_{CC} /ground current	I_{CC}	± 50	mA
Power dissipation	P_D	500 (DIP) (Note 2)/180 (SOP)	mW
Storage temperature	T_{stg}	$-65 \sim 150$	$^{\circ}\text{C}$

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 $T_a = -40$ to 65°C . From $T_a = 65$ to 85°C a derating factor of -10 mW/ $^{\circ}\text{C}$ should be applied up to 300 mW.

Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	4.5~5.5	V
Input voltage	V_{IN}	$0 \sim V_{CC}$	V
Output voltage	V_{OUT}	$0 \sim V_{CC}$	V
Operating temperature	T_{opr}	$-40 \sim 85$	$^{\circ}\text{C}$
Input rise and fall time	t_r, t_f	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 VCC or GND.

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40~85°C		Unit	
				VCC (V)	Min	Typ.	Max	Min		Max
High-level input voltage	VIH	—		4.5~5.5	2.0	—	—	2.0	—	V
Low-level input voltage	VIL	—		4.5~5.5	—	—	0.8	—	0.8	V
High-level output voltage	VOH	VIN = VIH or VIL	I _{OH} = -20 μA	4.5	4.4	4.5	—	4.4	—	V
			I _{OH} = -4 mA	4.5	4.18	4.31	—	4.13	—	
Low-level output voltage	VOL	VIN = VIH or VIL	I _{OL} = 20 μA	4.5	—	0.0	0.1	—	0.1	V
			I _{OL} = 4 mA	4.5	—	0.17	0.26	—	0.33	
Input leakage current	IIN	VIN = VCC or GND		5.5	—	—	±0.1	—	±1.0	μA
Quiescent supply current	ICC	VIN = VCC or GND		5.5	—	—	4.0	—	40.0	μA
	IC	Per input: VIN = 0.5 V or 2.4 V Other input: VCC 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} t_{THL}	—	—	6	12	ns
Propagation delay time ($P_n, Q_n - \overline{P=Q}$)	t_{pLH} t_{pHL}	—	—	17	27	ns
Propagation delay time ($\overline{G - P=Q}$)	t_{pLH} t_{pHL}	—	—	12	19	ns

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

Characteristics	Symbol	Test Condition	V _{CC} (V)	Ta = 25°C			Ta = −40~85°C		Unit
				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 (Pn, Qn- $\overline{P=Q}$)	t _{pLH}	—	4.5	—	21	32	—	40	ns
	t _{pHL}		5.5	—	18	29	—	36	
Propagation delay time ($\overline{G - P=Q}$)	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.

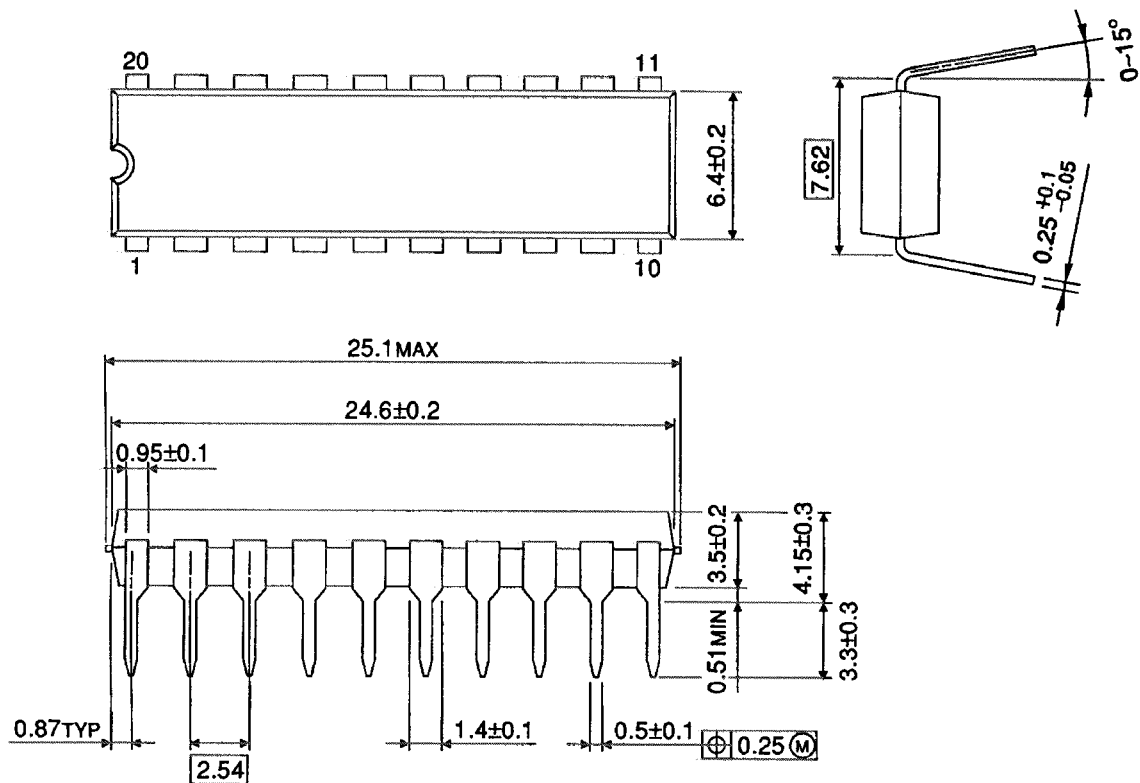
Average operating current can be obtained by the equation:

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

Package Dimensions

DIP20-P-300-2.54A

Unit : mm

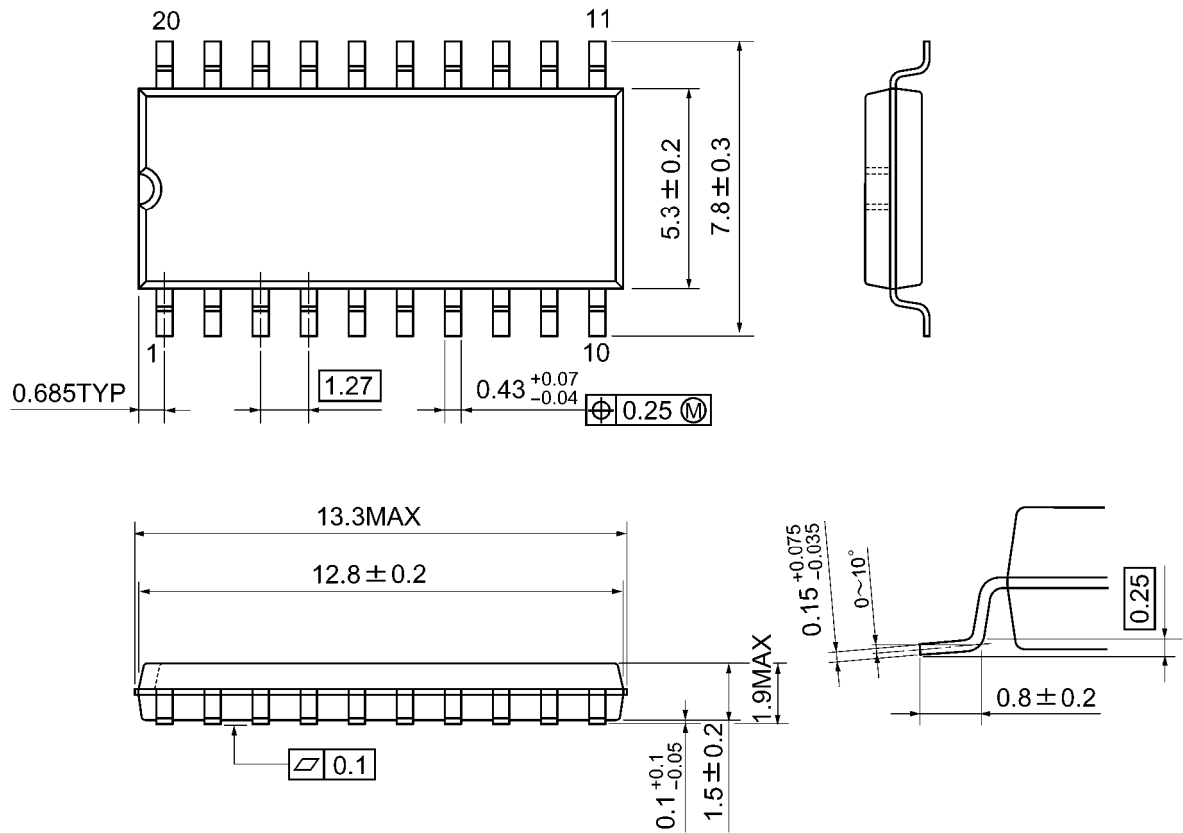


Weight: 1.30 g (typ.)

Package Dimensions

SOP20-P-300-1.27A

Unit: mm



Weight: 0.22 g (typ.)

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