

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74HC688AP, TC74HC688AF

8-Bit Equality Comparator

The TC74HC688A is a high speed CMOS 8-BIT EQUALITY COMPARATOR fabricated with silicon gate CMOS technology.

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

The TC74HC688A compares two 8-bit binary or BCD words applied inputs P0~P7, and inputs Q0~Q7, and indicates whether or not they are equal.

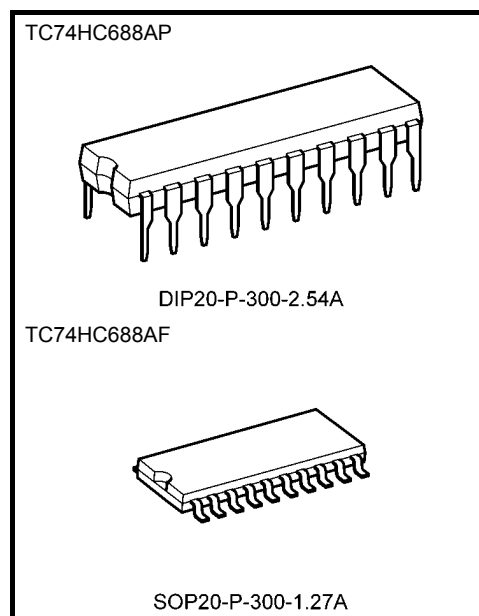
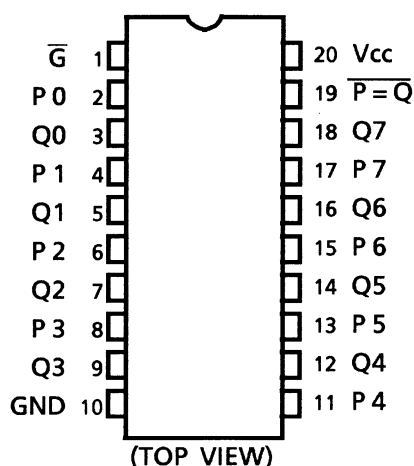
A signal active low enable is provided to facilitate cascading of several packages to compare words greater than 8 bits.

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

Features

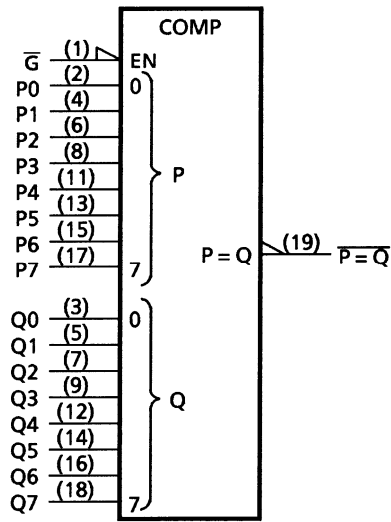
- High speed: $t_{pd} = 17 \text{ ns}$ (typ.) at $V_{CC} = 5 \text{ V}$
- Low power dissipation: $I_{CC} = 4 \mu\text{A}$ (max) at $T_a = 25^\circ\text{C}$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (min)
- Output drive capability: 10 LSTTL loads
- Symmetrical output impedance: $|I_{OH}| = I_{OL} = 4 \text{ mA}$ (min)
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: $V_{CC} \text{ (opr)} = 2\sim 6 \text{ V}$
- 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

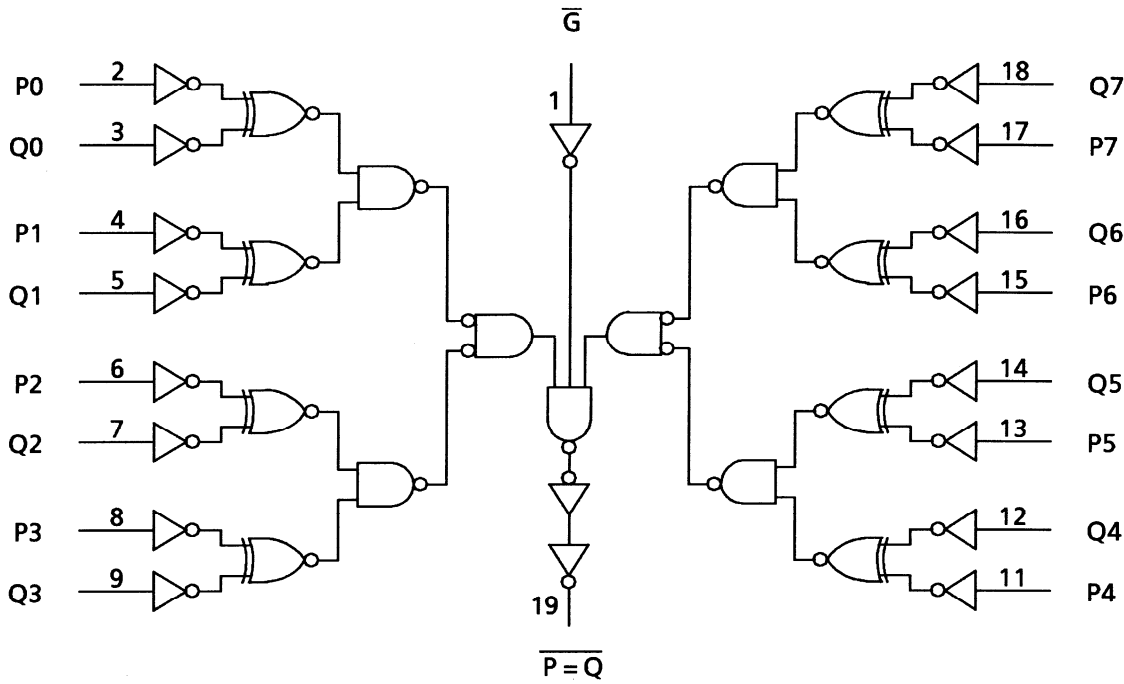


Truth Table

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 $-10 \text{ mW}/^{\circ}\text{C}$ should be applied until 300 mW.

Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2~6	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	0~1000 ($V_{CC} = 2.0 \text{ V}$) 0~500 ($V_{CC} = 4.5 \text{ V}$) 0~400 ($V_{CC} = 6.0 \text{ V}$)	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
				V _{CC} (V)	Min	Typ.	Max	Min	Max
High-level input voltage	V _{IH}	—		2.0 4.5 6.0	1.50 3.15 4.20	— — —	— — —	1.50 3.15 4.20	V
Low-level input voltage	V _{IL}	—		2.0 4.5 6.0	— — —	— — —	0.50 1.35 1.80	— — —	V
High-level output voltage	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -20 µA	2.0 4.5 6.0	1.9 4.4 5.9	2.0 4.5 6.0	— — —	1.9 4.4 5.9	V
				4.5 6.0	4.18 5.68	4.31 5.80	— —	4.13 5.63	
			I _{OH} = -4 mA I _{OH} = -5.2 mA	4.5 6.0	4.18 5.68	4.31 5.80	— —	4.13 5.63	
Low-level output voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 20 µA	2.0 4.5 6.0	— — —	0.0 0.0 0.0	0.1 0.1 0.1	— — —	V
				4.5 6.0	— —	0.17 0.18	0.26 0.26	— —	
			I _{OL} = 4 mA I _{OL} = 5.2 mA	4.5 6.0	— —	0.17 0.18	0.26 0.26	— —	
Input leakage current	I _{IN}	V _{IN} = V _{CC} or GND		6.0	—	—	±0.1	—	µA
Quiescent supply current	I _{CC}	V _{IN} = V _{CC} or GND		6.0	—	—	4.0	—	µA

AC Characteristics (C_L = 15 pF, V_{CC} = 5 V, Ta = 25°C, input: t_r = t_f = 6 ns)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Output transition time	t _{TLH} t _{THL}	—	—	4	8	ns
Propagation delay time (P _n , Q _n - $\overline{P=Q}$)	t _{pLH} t _{pHL}	—	—	17	29	ns
Propagation delay time ($\overline{G-P=Q}$)	t _{pLH} t _{pHL}	—	—	10	18	ns

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

Characteristics	Symbol	Test Condition	V_{CC} (V)	$T_a = 25^\circ\text{C}$			$T_a = -40 \sim 85^\circ\text{C}$		Unit
				Min	Typ.	Max	Min	Max	
Output transition time	t_{TLH}	—	2.0	—	30	75	—	95	ns
	t_{THL}		4.5	—	8	15	—	19	
			6.0	—	7	13	—	16	
Propagation delay time ($P_n, Q_n - \overline{P} = \overline{Q}$)	t_{pLH}	—	2.0	—	60	170	—	215	ns
	t_{pHL}		4.5	—	21	34	—	43	
			6.0	—	17	29	—	37	
Propagation delay time ($\overline{G} - \overline{P} = \overline{Q}$)	t_{pLH}	—	2.0	—	40	110	—	140	ns
	t_{pHL}		4.5	—	13	22	—	28	
			6.0	—	10	19	—	24	
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.

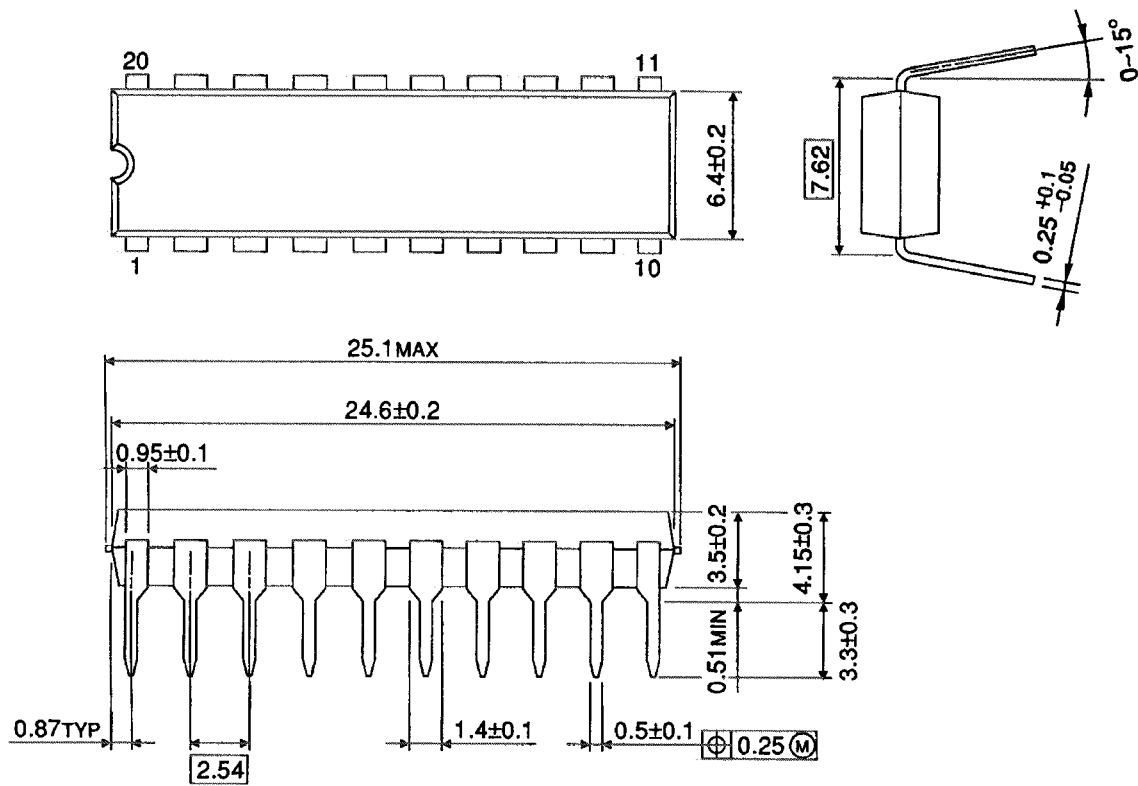
Average operating current can be obtained by the equation:

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

Package Dimensions

DIP20-P-300-2.54A

Unit : mm

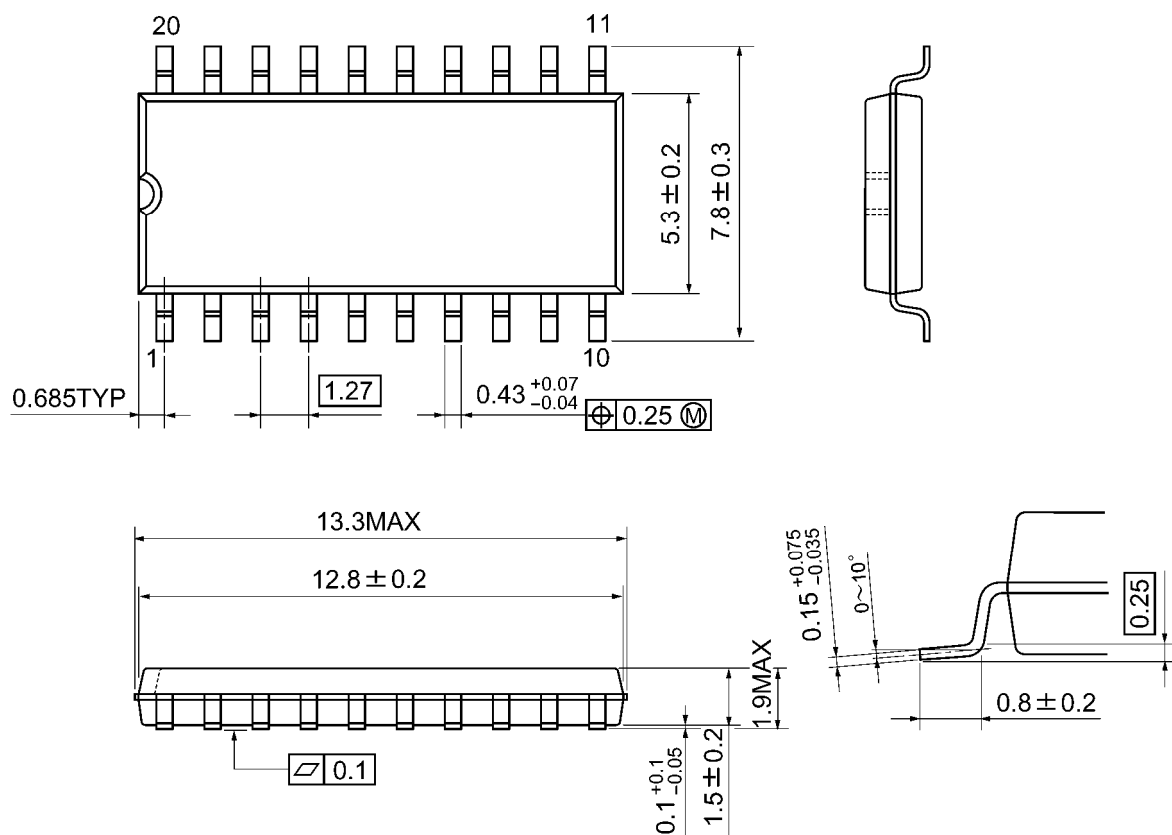


Weight: 1.30 g (typ.)

Package Dimensions

SOP20-P-300-1.27A

Unit: mm



Weight: 0.22 g (typ.)

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