

## MM54HCT688/MM74HCT688 8-Bit Magnitude Comparator (Equality Detector)

### General Description

This equality detector utilizes advanced silicon-gate CMOS technology to compare bit for bit two 8-bit words and indicate whether or not they are equal. The  $P=Q$  output indicates equality when it is low. A single active low enable is provided to facilitate cascading of several packages and enable comparison of words greater than 8 bits.

This device is useful in memory block decoding applications, where memory block enable signals must be generated from computer address information.

The comparator combines the low power consumption of CMOS, but inputs are compatible with TTL logic levels, and the output can drive 10 low power Schottky equivalent loads.

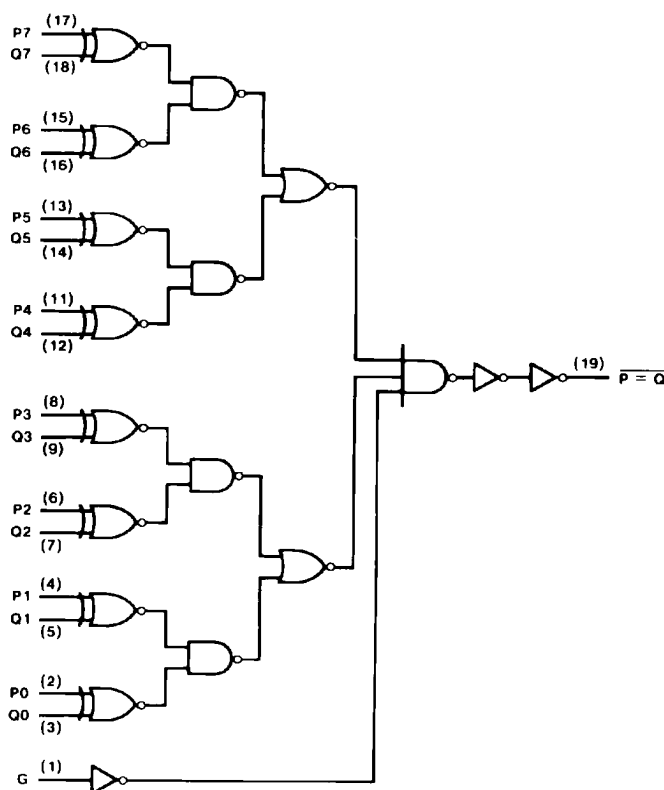
MM54HCT/MM74HCT devices are intended to interface between TTL and NMOS components and standard CMOS devices. These parts are also plug in replacements for LS-TTL devices and can be used to reduce power consumption in existing designs.

All inputs are protected from damage due to static discharge by diodes to  $V_{CC}$  and ground.

### Features

- TTL input compatible
- Typical propagation delay: 20 ns
- Low quiescent current: 80  $\mu$ A maximum (74HCT Series)
- Large output current: 4 mA
- Same as HCT521

### Logic Diagrams



TL/F/5371-2

**Absolute Maximum Ratings** (Notes 1 & 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

|                                                  |                         |
|--------------------------------------------------|-------------------------|
| Supply Voltage ( $V_{CC}$ )                      | −0.5 to +7.0V           |
| DC Input Voltage ( $V_{IN}$ )                    | −1.5 to $V_{CC} + 1.5V$ |
| DC Output Voltage ( $V_{OUT}$ )                  | −0.5 to $V_{CC} + 0.5V$ |
| Clamp Diode Current ( $I_{IK}, I_{OK}$ )         | ±20 mA                  |
| DC Output Current, per pin ( $I_{OUT}$ )         | ±25 mA                  |
| DC $V_{CC}$ or GND Current, per pin ( $I_{CC}$ ) | ±50 mA                  |
| Storage Temperature Range ( $T_{STG}$ )          | −65°C to +150°C         |
| Power Dissipation ( $P_D$ )                      |                         |
| (Note 3)                                         | 600 mW                  |
| S.O. Package only                                | 500 mW                  |
| Lead Temperature ( $T_L$ )                       |                         |
| (Soldering 10 seconds)                           | 260°C                   |

**Operating Conditions**

|                                                  | Min | Max      | Units |
|--------------------------------------------------|-----|----------|-------|
| Supply Voltage ( $V_{CC}$ )                      | 4.5 | 5.5      | V     |
| DC Input or Output Voltage ( $V_{IN}, V_{OUT}$ ) | 0   | $V_{CC}$ | V     |
| Operating Temp. Range ( $T_A$ )                  |     |          |       |
| MM74HCT688                                       | −40 | +85      | °C    |
| MM54HCT688                                       | −55 | +125     | °C    |
| Input Rise or Fall Times ( $t_r, t_f$ )          |     | 500      | ns    |

**DC Electrical Characteristics** ( $V_{CC} = 5V \pm 10\%$  unless otherwise specified)

| Symbol          | Parameter                         | Conditions                                                          | T <sub>A</sub> = 25°C |                       | 74HCT<br>T <sub>A</sub> = −40 to 85°C | 54HCT<br>T <sub>A</sub> = −55 to 125°C | Units |
|-----------------|-----------------------------------|---------------------------------------------------------------------|-----------------------|-----------------------|---------------------------------------|----------------------------------------|-------|
|                 |                                   |                                                                     | Typ                   | Guaranteed Limits     |                                       |                                        |       |
| V <sub>IH</sub> | Minimum High Level Input Voltage  |                                                                     |                       | 2.0                   | 2.0                                   | 2.0                                    | V     |
| V <sub>IL</sub> | Maximum Low Level Input Voltage   |                                                                     |                       | 0.8                   | 0.8                                   | 0.8                                    | V     |
| V <sub>OH</sub> | Minimum High Level Output Voltage | V <sub>IN</sub> = 0.8V or 2.0V                                      |                       |                       |                                       |                                        |       |
|                 |                                   | I <sub>OUT</sub>   = 20 μA                                          | V <sub>CC</sub>       | V <sub>CC</sub> − 0.1 | V <sub>CC</sub> − 0.1                 | V <sub>CC</sub> − 0.1                  | V     |
|                 |                                   | I <sub>OUT</sub>   = 4.0 mA, V <sub>CC</sub> = 4.5V                 | 4.2                   | 3.98                  | 3.84                                  | 3.7                                    | V     |
|                 |                                   | I <sub>OUT</sub>   = 4.8 mA, V <sub>CC</sub> = 5.5V                 | 5.7                   | 4.98                  | 4.84                                  | 4.7                                    | V     |
| V <sub>OL</sub> | Maximum Low Level Voltage         | V <sub>IN</sub> = 0.8V or 2.0V                                      |                       |                       |                                       |                                        |       |
|                 |                                   | I <sub>OUT</sub>   = 20 μA                                          | 0                     | 0.1                   | 0.1                                   | 0.1                                    | V     |
|                 |                                   | I <sub>OUT</sub>   = 4.0 mA, V <sub>CC</sub> = 4.5V                 | 0.2                   | 0.26                  | 0.33                                  | 0.4                                    | V     |
|                 |                                   | I <sub>OUT</sub>   = 4.8 mA, V <sub>CC</sub> = 5.5V                 | 0.2                   | 0.26                  | 0.33                                  | 0.4                                    | V     |
| I <sub>IN</sub> | Maximum Input Current             | V <sub>IN</sub> = V <sub>CC</sub> or GND                            |                       | ±0.1                  | ±1.0                                  | ±1.0                                   | μA    |
| I <sub>CC</sub> | Maximum Quiescent Supply Current  | V <sub>IN</sub> = V <sub>CC</sub> or GND<br>I <sub>OUT</sub> = 0 μA |                       | 8.0                   | 80                                    | 160                                    | μA    |
|                 |                                   | V <sub>IN</sub> = 2.4V or 0.5V (Note 4)                             |                       | 0.3                   | 0.4                                   | 0.5                                    | mA    |

**Note 1:** Absolute Maximum Ratings are those values beyond which damage to the device may occur.

**Note 2:** Unless otherwise specified all voltages are referenced to ground.

**Note 3:** Power Dissipation temperature derating — plastic “N” package: −12 mW/°C from 65°C to 85°C; ceramic “J” package: −12 mW/°C from 100°C to 125°C.

**Note 4:** Measured per pin. All other inputs held at  $V_{CC}$  or ground.

## AC Electrical Characteristics

$V_{CC} = 5V$ ,  $T_A = 25^\circ C$ ,  $C_L = 15\text{ pF}$ ,  $t_r = t_f = 6\text{ ns}$  (unless otherwise specified)

| Symbol    | Parameter                                    | Conditions | Typ | Guaranteed Limit | Units |
|-----------|----------------------------------------------|------------|-----|------------------|-------|
| $t_{PHL}$ | Maximum Propagation Delay - P or Q to Output |            | 19  | 30               | ns    |
| $t_{PLH}$ | Maximum Propagation Delay - P or Q to Output |            | 13  | 22               | ns    |
| $t_{PHL}$ | Maximum Propagation Delay - Enable to Output |            | 13  | 20               | ns    |
| $t_{PHL}$ | Maximum Propagation Delay - Enable to Output |            | 10  | 18               | ns    |

## AC Electrical Characteristics

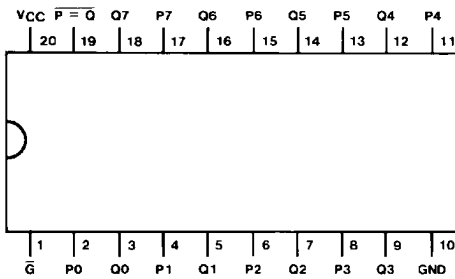
$V_{CC} = 5V \pm 10\%$ ,  $C_L = 50\text{ pF}$ ,  $t_r = t_f = 6\text{ ns}$  (unless otherwise specified)

| Symbol                              | Parameter                                    | Conditions | T <sub>A</sub> = 25°C |                   | 74HCT | 54HCT                         | Units |
|-------------------------------------|----------------------------------------------|------------|-----------------------|-------------------|-------|-------------------------------|-------|
|                                     |                                              |            | Typ                   | Guaranteed Limits |       | T <sub>A</sub> = − 40 to 85°C |       |
| t <sub>PHL</sub>                    | Maximum Propagation Delay - P or Q to Output |            | 23                    | 35                | 44    | 53                            | ns    |
| t <sub>PLH</sub>                    | Maximum Propagation Delay - P or Q to Output |            | 16                    | 24                | 30    | 36                            | ns    |
| t <sub>PHL</sub>                    | Maximum Propagation Delay - Enable to Output |            | 16                    | 24                | 30    | 36                            | ns    |
| t <sub>PLH</sub>                    | Maximum Propagation Delay - Enable to Output |            | 11                    | 20                | 25    | 30                            | ns    |
| t <sub>THL</sub> , t <sub>TLH</sub> | Maximum Output Rise and Fall Time            |            | 8                     | 15                | 19    | 22                            | ns    |
| C <sub>PD</sub>                     | Power Dissipation Capacitance (Note 5)       |            | 45                    |                   |       |                               | pF    |
| C <sub>IN</sub>                     | Maximum Input Capacitance                    |            | 5                     | 10                | 10    | 10                            | pF    |

**Note 5:**  $C_{PD}$  determines the no load dynamic power consumption,  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ , and the no load dynamic current consumption,  $I_S = C_{PD} V_{CC} + I_{CC}$ .

## Connection Diagram

Dual-In-Line Package



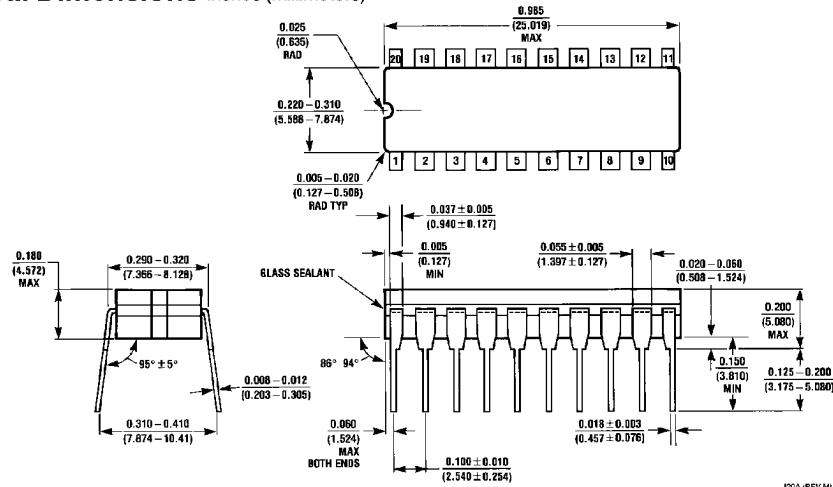
Top View

Order Number MM54HCT688 or MM74HCT688

## Truth Table

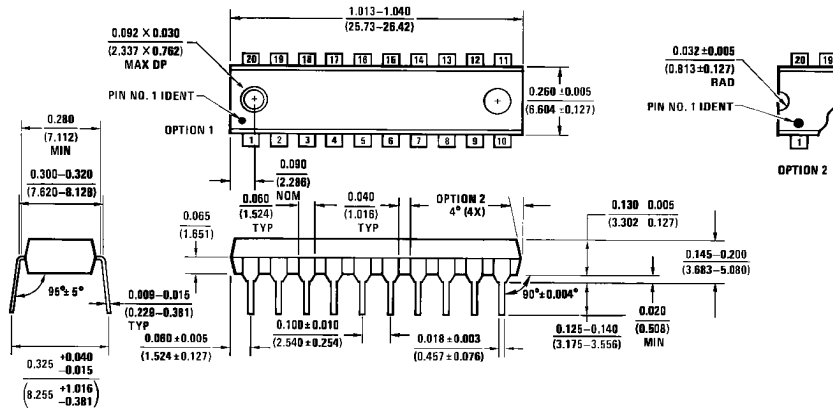
| Inputs       |                          | $\overline{P=Q}$ |
|--------------|--------------------------|------------------|
| Data<br>P, Q | Enable<br>$\overline{G}$ |                  |
| $P=Q$        | L                        | L                |
| $P>Q$        | L                        | H                |
| $P<Q$        | L                        | H                |
| X            | H                        | H                |

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**Physical Dimensions** inches (millimeters)

Order Number MM54HCT688J or MM74HCT688J  
NS Package J20A

J20A (REV M)



N20A (REV G)

Order Number MM74HCT688N  
NS Package N20A

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**National Semiconductor Corporation**  
1111 West Bardin Road  
Arlington, TX 76017  
Tel: 1(800) 272-9959  
Fax: 1(800) 737-7018

**National Semiconductor Europe**

Fax: (+49) 0-180-530 85 86  
Email: cnjwge@tevm2.nsc.com  
Deutsch Tel: (+49) 0-180-530 85 85  
English Tel: (+49) 0-180-532 78 32  
Français Tel: (+49) 0-180-532 93 58  
Italiano Tel: (+49) 0-180-534 16 80

**National Semiconductor Hong Kong Ltd.**

13th Floor, Straight Block,  
Ocean Centre, 5 Canton Rd.  
Tsimshatsui, Kowloon  
Hong Kong  
Tel: (852) 2737-1600  
Fax: (852) 2736-9960

**National Semiconductor Japan Ltd.**

Tel: 81-043-299-2309  
Fax: 81-043-299-2406

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