

# TC74HC153P/F

# TC74HC253P/F

T-67-21-51

TC74HC153P/F DUAL 4-CHANNEL MULTIPLEXER

TC74HC253P/F DUAL 4-CHANNEL MULTIPLEXER WITH 3-STATE OUTPUT

The TC74HC153 and TC74HC253 are high speed CMOS DUAL 4-CHANNEL MULTIPLEXERS fabricated with silicon gate C<sup>2</sup>MOS technology.

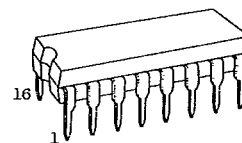
Both achieve the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipations.

The designer has a choice of complementary output (HC153) and 3-state output (HC253). Each of these data (1C0-1C3, 2C0-2C3) is selected by the two address inputs A and B. Separate strobe inputs ( $\overline{1G}$ ,  $\overline{2G}$ ) are provided for each of the two four-line sections. The strobe input ( $\overline{G}$ ) can be used to inhibit the data output; the output of HC153 is fixed in low level and the output of HC253 is disabled to be high impedance unconditionally, while the strobe input is held low.

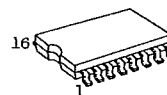
All inputs are equipped with protection circuit against static discharge or transient excess voltage.

#### FEATURES:

- . High Speed..... $t_{pd}=14ns$ (Typ.) at  $V_{CC}=5V$
- . Low Power Dissipation..... $I_{CC}=4\mu A$ (Max.) at  $T_a=25^\circ C$
- . High Noise Immunity..... $V_{NIH}=V_{NIL}=28\% V_{CC}$ (Min.)
- . Output Drive Capability.....10 LSTTL Loads
- . Symmetrical Output Impedance... $|I_{OH}|=I_{OL}=4mA$ (Min.)
- . Balanced Propagation Delays... $t_{pLH}\cong t_{pHL}$
- . Wide Operating Voltage Range... $V_{CC}(opr)=2V\sim 6V$
- . Pin and Function Compatible with 74LS153/253.



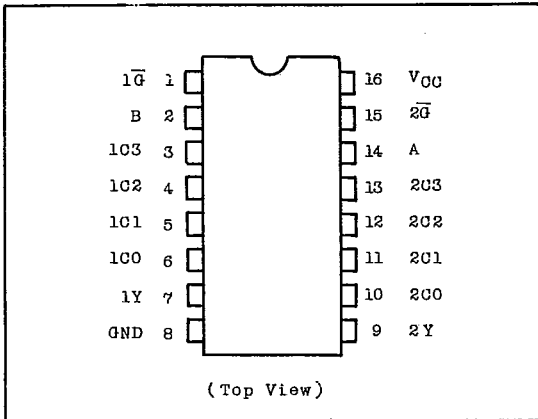
DIP16(3D16A-P)



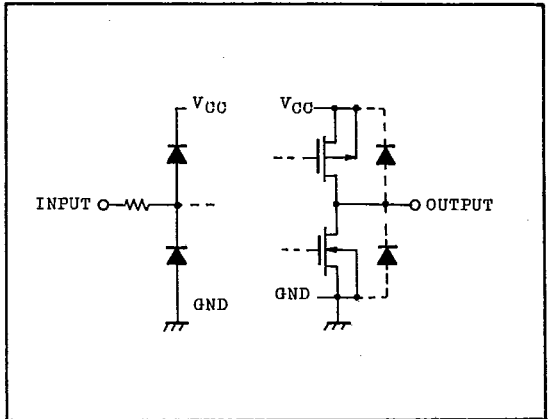
MFP16(F1600-P)

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PIN ASSIGNMENT



INPUT and OUTPUT EQUIVALENT CIRCUIT



TRUTH TABLE

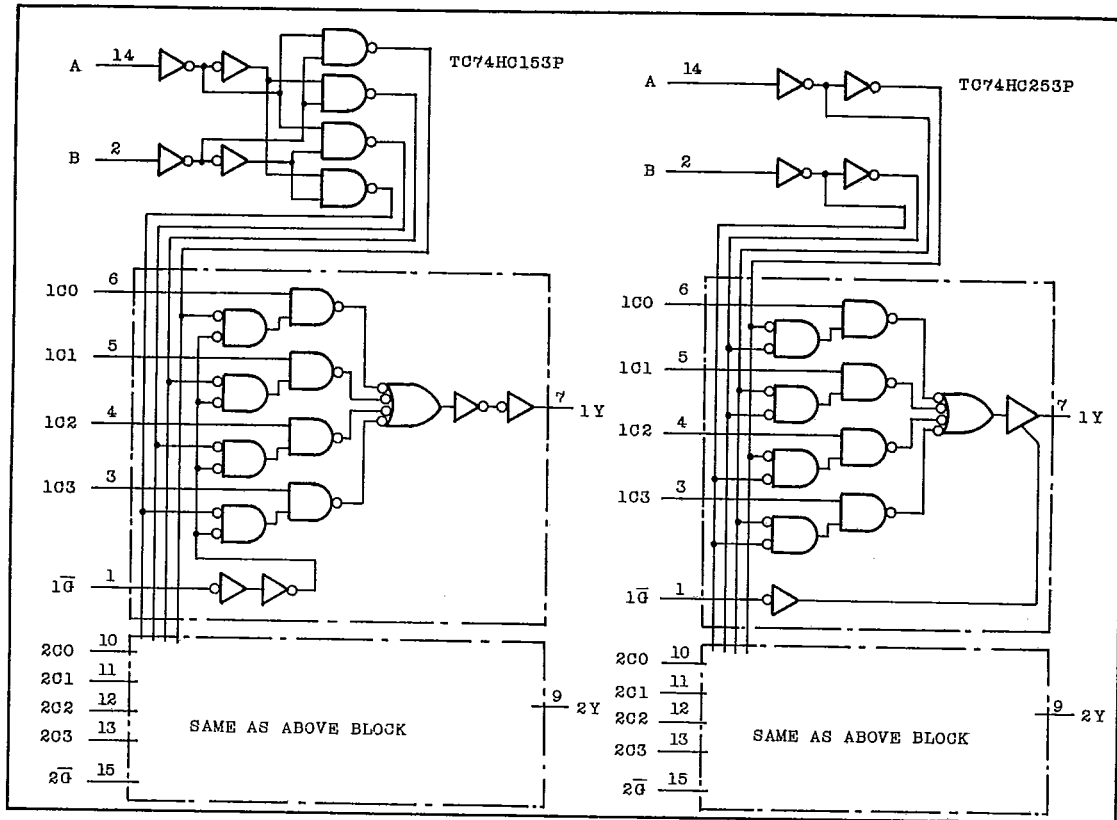
| SELECT INPUTS |   | DATA INPUTS    |                |                |                | STROBE    | OUTPUT Y |       |
|---------------|---|----------------|----------------|----------------|----------------|-----------|----------|-------|
| B             | A | C <sub>0</sub> | C <sub>1</sub> | C <sub>2</sub> | C <sub>3</sub> | $\bar{G}$ | HC153    | HC253 |
| X             | X | X              | X              | X              | X              | H         | L        | Z     |
| L             | L | L              | X              | X              | X              | L         | L        | L     |
| L             | L | H              | X              | X              | X              | L         | H        | H     |
| L             | H | X              | L              | X              | X              | L         | L        | L     |
| L             | H | X              | H              | X              | X              | L         | H        | H     |
| H             | L | X              | X              | L              | X              | L         | L        | L     |
| H             | L | X              | X              | H              | X              | L         | H        | H     |
| H             | H | X              | X              | X              | L              | L         | L        | L     |
| H             | H | X              | X              | X              | H              | L         | H        | H     |

X : Don't care  
 Z : High Impedance

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LOGIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

| PARAMETER                          | SYMBOL           | VALUE                       | UNIT |
|------------------------------------|------------------|-----------------------------|------|
| Supply Voltage Range               | V <sub>CC</sub>  | -0.5 ~ 7                    | 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)*/180(MFP)          | mW   |
| Storage Temperature                | T <sub>stg</sub> | -65 ~ 150                   | °C   |
| Lead Temperature 10sec             | T <sub>L</sub>   | 300                         | °C   |

\* 500mW in the range of Ta=-40°C~65°C. and from Ta=65°C up to 85°C derating factor of -10mW/°C shall be applied until 300mW.

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## RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | SYMBOL     | LIMIT  | UNIT |
|--------------------------|------------|--|------|
| Supply Voltage           | $V_{CC}$   | 2 ~ 6  | V    |
| Input Voltage            | $V_{IN}$   | 0 ~ $V_{CC}$   | V    |
| Output Voltage           | $V_{OUT}$  | 0 ~ $V_{CC}$   | V    |
| Operating Temperature    | $T_{opr}$  | -40 ~ 85   | °C   |
| Input Rise and Fall Time | $t_r, t_f$ | 0 ~ 1000 ( $V_{CC}=2.0V$ )<br>0 ~ 500 ( $V_{CC}=4.5V$ )<br>0 ~ 400 ( $V_{CC}=6.0V$ ) | ns   |

## DC ELECTRICAL CHARACTERISTICS

| PARAMETER                        | SYMBOL      | TEST CONDITION   | Ta=25°C           |      |      | Ta=-40~85°C |      | UNIT |      |   |
|----------------------------------|-------------|--|-------------------|------|------|-------------|------|------|------|---|
|                                  |             |  | VCC               | MIN. | TYP. | MAX.        | MIN. |      | MAX. |   |
| High-Level Input Voltage         | $V_{IH}$    |  | 2.0               | 1.5  | -    | -           | 1.5  | -    | V    |   |
|                                  |             |  | 4.5               | 3.15 | -    | -           | 3.15 | -    |      |   |
|                                  |             |  | 6.0               | 4.2  | -    | -           | 4.2  | -    |      |   |
| Low-Level Input Voltage          | $V_{IL}$    |  | 2.0               | -    | -    | 0.5         | -    | 0.5  | V    |   |
|                                  |             |  | 4.5               | -    | -    | 1.35        | -    | 1.35 |      |   |
|                                  |             |  | 6.0               | -    | -    | 1.8         | -    | 1.8  |      |   |
| High-Level Output Voltage        | $V_{OH}$    | $V_{IN}=V_{IH}$ or $V_{IL}$                            | $I_{OH}=-20\mu A$ | 2.0  | 1.9  | 2.0         | -    | 1.9  | -    | V |
|                                  |             |  |                   | 4.5  | 4.4  | 4.5         | -    | 4.4  | -    |   |
|                                  |             |  | 6.0               | 5.9  | 6.0  | -           | 5.9  | -    |      |   |
|                                  |             |  | $I_{OH}=-4mA$     | 4.5  | 4.18 | 4.31        | -    | 4.13 | -    |   |
| 6.0                              | 5.68        | 5.80   |                   | -    | 5.63 | -           |      |      |      |   |
| Low-Level Output Voltage         | $V_{OL}$    | $V_{IN}=V_{IH}$ or $V_{IL}$                            | $I_{OL}=20\mu A$  | 2.0  | -    | 0.0         | 0.1  | -    | 0.1  | V |
|                                  |             |  |                   | 4.5  | -    | 0.0         | 0.1  | -    | 0.1  |   |
|                                  |             |  | 6.0               | -    | 0.0  | 0.1         | -    | 0.1  |      |   |
|                                  |             |  | $I_{OL}=4mA$      | 4.5  | -    | 0.17        | 0.26 | -    | 0.33 |   |
| 6.0                              | -           | 0.18   |                   | 0.26 | -    | 0.33        |      |      |      |   |
| 3-State Output Off-State Current | $I_{OZ}(1)$ | $V_{IN}=V_{IH}$ or $V_{IL}$<br>$V_{OUT}=V_{CC}$ or GND | 6.0               | -    | -    | ±0.5        | -    | ±5.0 | μA   |   |
| Input Leakage Current            | $I_{IN}$    | $V_{IN}=V_{CC}$ or GND                                 | 6.0               | -    | -    | ±0.1        | -    | ±1.0 |      |   |
| Quiescent Supply Current         | $I_{CC}$    | $V_{IN}=V_{CC}$ or GND                                 | 6.0               | -    | -    | 4.0         | -    | 40.0 |      |   |

Note (1) Applied only for TC74HC253P

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AC ELECTRICAL CHARACTERISTICS (C<sub>L</sub>=50pF, Input t<sub>r</sub>=t<sub>f</sub>=6ns)

| PARAMETER   | SYMBOL                               | TEST CONDITION      | Ta=25°C |      |      | Ta=-40~85°C |      | UNIT |      |
|---|--------------------------------------|---------------------|---------|------|------|-------------|------|------|------|
|   |                                      |                     | VCC     | MIN. | TYP. | MAX.        | MIN. |      | MAX. |
| Output Transition Time  | t <sub>TLH</sub><br>t <sub>THL</sub> |                     | 2.0     | -    | 25   | 75          | -    | 95   | ns   |
|   |                                      |                     | 4.5     | -    | 9    | 15          | -    | 19   |      |
|   |                                      |                     | 6.0     | -    | 8    | 13          | -    | 16   |      |
| TC74HC153/253<br>Propagation Delay Time<br>C <sub>n</sub> - Y | t <sub>pLH</sub><br>t <sub>pHL</sub> |                     | 2.0     | -    | 68   | 130         | -    | 165  |      |
|   |                                      |                     | 4.5     | -    | 17   | 26          | -    | 33   |      |
|   |                                      |                     | 6.0     | -    | 14   | 22          | -    | 28   |      |
| TC74HC153/253<br>A, B - Y                                     | t <sub>pLH</sub><br>t <sub>pHL</sub> |                     | 2.0     | -    | 100  | 195         | -    | 245  |      |
|   |                                      |                     | 4.5     | -    | 25   | 39          | -    | 49   |      |
|   |                                      |                     | 6.0     | -    | 21   | 33          | -    | 42   |      |
| TC74HC153<br>Propagation Delay Time<br>G - Y                  | t <sub>pLH</sub><br>t <sub>pHL</sub> |                     | 2.0     | -    | 100  | 195         | -    | 245  |      |
|   |                                      |                     | 4.5     | -    | 25   | 39          | -    | 49   |      |
|   |                                      |                     | 6.0     | -    | 21   | 33          | -    | 42   |      |
| TC74HC253<br>Output Enable Time                               | t <sub>pZL</sub><br>t <sub>pZH</sub> | R <sub>L</sub> =1kΩ | 2.0     | -    | 46   | 100         | -    | 125  |      |
|   |                                      |                     | 4.5     | -    | 12   | 20          | -    | 25   |      |
|   |                                      |                     | 6.0     | -    | 10   | 17          | -    | 21   |      |
| TC74HC253<br>Output Disable Time                              | t <sub>pLZ</sub><br>t <sub>pHZ</sub> | R <sub>L</sub> =1kΩ | 2.0     | -    | 56   | 115         | -    | 145  |      |
|   |                                      |                     | 4.5     | -    | 14   | 23          | -    | 29   |      |
|   |                                      |                     | 6.0     | -    | 12   | 20          | -    | 25   |      |
| Input Capacitance   | C <sub>IN</sub>                      |                     | -       | 5    | 10   | -           | 10   | pF   |      |
| Output Capacitance  | C <sub>OUT</sub>                     | TC74HC253           | -       | 7    | -    | -           | -    |      |      |
| Power Dissipation<br>Capacitance                              | C <sub>PD</sub> (1)                  | TC74HC153           | -       | 56   | -    | -           | -    |      |      |
|   |                                      | TC74HC253           | -       | 56   | -    | -           | -    |      |      |

Note (1) C<sub>pd</sub> is defined as the value of internal equivalent capacitance of IC which is calculated from the operating current consumption without load (refer to Test Circuit).

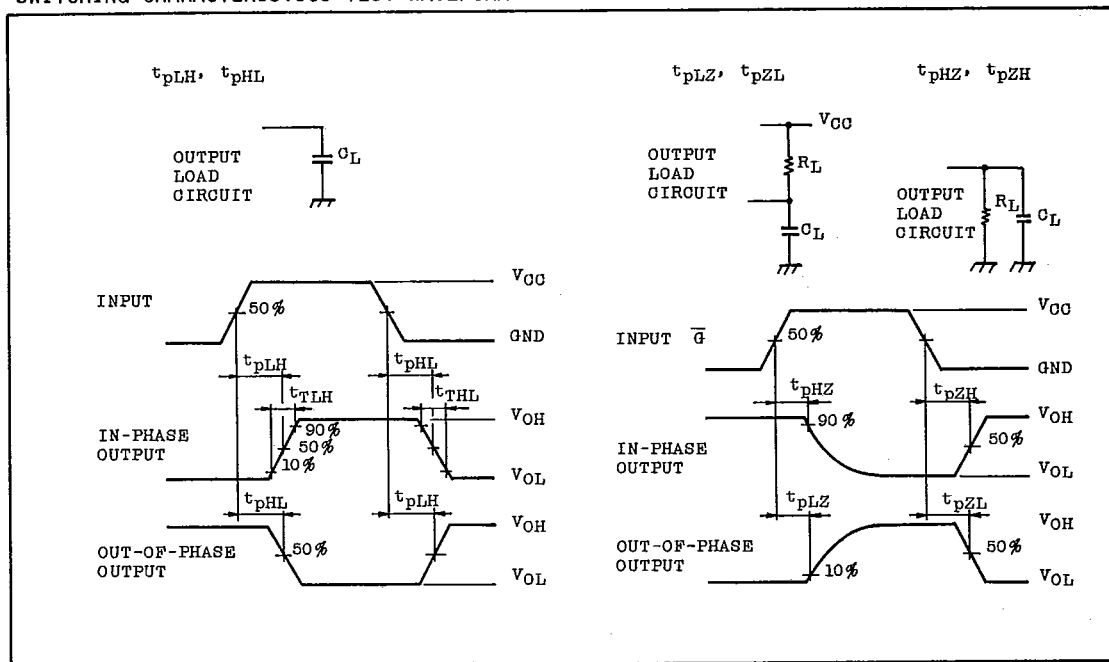
Average operating current can be obtained by the equation hereunder.

$$I_{CC(opr)} = C_{pd} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2 \text{ (per Channel)}$$

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SWITCHING CHARACTERISTICS TEST WAVEFORM



$I_{CC(opr)}$  TEST CIRCUIT

