

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7MH257FK

Quad 2-Channel Multiplexer (3-State)

The TC7MH257FK is an advanced high speed CMOS multiplexer fabricated with silicon gate C²MOS technology.

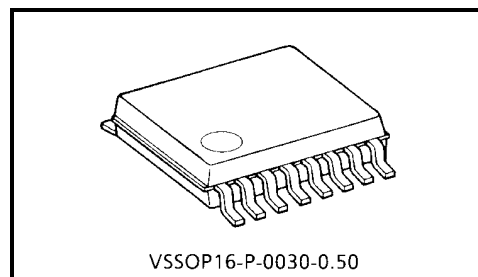
It achieves the high speed operation similar to equivalent bipolar schottky TTL while maintaining the CMOS low power dissipation.

It is composed of four independent 2-channel multiplexers with common SELECT and $\overline{\text{OUTPUTENABLE}}$ ($\overline{\text{OE}}$).

If $\overline{\text{OE}}$ is set low, the outputs are held in a high-impedance state. When SELECT is set low, "A" data inputs are enabled.

Conversely, when SELECT is high, "B" data inputs are enabled.

An input protection circuit ensures that 0 to 7 V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5 V to 3 V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.



Weight: 0.02 g (typ.)

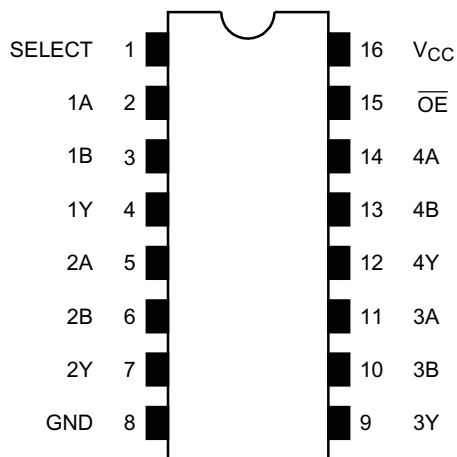
Features

- High speed: $t_{pd} = 3.6 \text{ ns}$ (typ.) ($V_{CC} = 5 \text{ V}$)
- Low power dissipation: $I_{CC} = 4 \mu\text{A}$ (max) ($T_a = 25^\circ\text{C}$)
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (min)
- Power down protection is provided on all inputs.
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: $V_{CC}(\text{opr}) = 2 \sim 5.5 \text{ V}$
- Low noise: $V_{OLP} = 0.8 \text{ V}$ (max)
- Pin and function compatible with 74ALS257

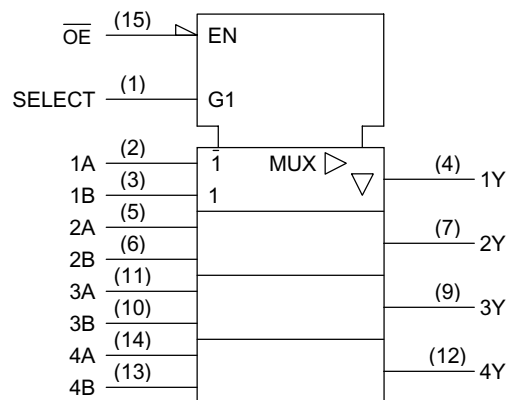
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Pin Assignment (top view)



IEC Logic Symbol



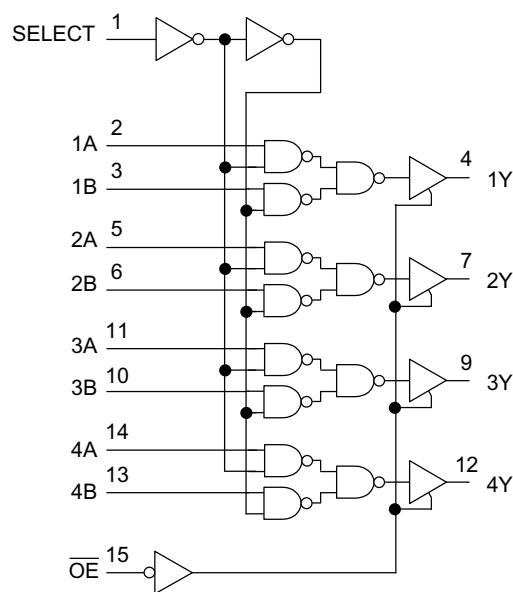
Truth Table

| Inputs | | | | Outputs |
|------------------------|--------|---|---|---------|
| $\overline{\text{OE}}$ | Select | A | B | |
| H | X | X | X | Z |
| L | L | L | X | L |
| L | L | H | X | H |
| L | H | X | L | L |
| L | H | X | H | H |

X: Don't care

Z: High impedance

System Diagram



Maximum Ratings

| Characteristics | Symbol | Rating | Unit |
|-----------------------------|-----------|----------------------|------|
| Supply voltage range | V_{CC} | -0.5~7.0 | V |
| DC input voltage | V_{IN} | -0.5~7.0 | V |
| DC output voltage | V_{OUT} | -0.5~ $V_{CC} + 0.5$ | 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 | 180 | mW |
| Storage temperature | T_{stg} | -65~150 | °C |

Recommended Operating Conditions

| Characteristics | Symbol | Rating | Unit |
|--------------------------|-----------|-----------------------------------|------|
| Supply voltage | V_{CC} | 2.0~5.5 | V |
| Input voltage | V_{IN} | 0~5.5 | V |
| Output voltage | V_{OUT} | 0~ V_{CC} | V |
| Operating temperature | T_{opr} | -40~85 | °C |
| Input rise and fall time | dt/dv | 0~100 ($V_{CC} = 3.3 \pm 0.3$ V) | ns/V |
| | | 0~20 ($V_{CC} = 5 \pm 0.5$ V) | |

Electrical Characteristics

DC Characteristics

| Characteristics | | Symbol | Test Condition | | Ta = 25°C | | | | Ta = -40~85°C | | Unit |
|----------------------------------|------------|--------|---------------------------------------|--------------|-------------|--------------|------|--------------|---------------|--------------|------|
| | | | | | VCC (V) | Min | Typ. | Max | Min | Max | |
| Input voltage | High level | VIH | — | | 2.0 | 1.50 | — | — | 1.50 | — | V |
| | | | | | 3.0~5.5 | VCC × 0.7 | — | — | VCC × 0.7 | — | |
| | Low level | VIL | — | | 2.0 | — | — | 0.50 | — | 0.50 | |
| | | | | | 3.0~5.5 | — | — | VCC × 0.3 | — | VCC × 0.3 | |
| Output voltage | High level | VOH | VIN = VIH or VIL | IOH = -50 μA | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V |
| | | | | | 3.0 | 2.9 | 3.0 | — | 2.9 | — | |
| | | | | | 4.5 | 4.4 | 4.5 | — | 4.4 | — | |
| | | | | IOH = -4 mA | 3.0 | 2.58 | — | — | 2.48 | — | |
| | | | | | IOH = -8 mA | 4.5 | 3.94 | — | — | 3.80 | |
| | Low level | VOL | VIN = VIH or VIL | IOL = 50 μA | 2.0 | — | 0 | 0.1 | — | 0.1 | |
| | | | | | 3.0 | — | 0 | 0.1 | — | 0.1 | |
| | | | | | 4.5 | — | 0 | 0.1 | — | 0.1 | |
| | | | | IOL = 4 mA | 3.0 | — | — | 0.36 | — | 0.44 | |
| | | | | | IOL = 8 mA | 4.5 | — | — | 0.36 | — | |
| 3-state output off-state current | | IOZ | VIN = VIH or VIL VOUT = VCC or GND | | 5.5 | — | — | ±0.25 | — | ±2.50 | μA |
| Input leakage current | | IIN | VIN = 5.5 V or GND | | 0~5.5 | — | — | ±0.1 | — | ±1.0 | μA |
| Quiescent supply current | | ICC | VIN = VCC or GND | | 5.5 | — | — | 4.0 | — | 40.0 | μA |

AC Characteristics (Input: $t_r = t_f = 3\text{ ns}$)

| Characteristics | Symbol | Test Condition | | | Ta = 25°C | | | Ta = −40~85°C | | Unit |
|--------------------------------------|------------------------|-----------------------|---------------------|---------------------|-----------|------|------|---------------|------|------|
| | | | V _{CC} (V) | C _L (pF) | Min | Typ. | Max | Min | Max | |
| Propagation delay time (A, B-Y) | t_{pLH} t_{pHL} | — | 3.3 ± 0.3 | 15 | — | 5.8 | 9.3 | 1.0 | 11.0 | ns |
| | | | | 50 | — | 8.3 | 12.8 | 1.0 | 14.5 | |
| | | | 5.0 ± 0.5 | 15 | — | 3.6 | 5.9 | 1.0 | 7.0 | |
| | | | | 50 | — | 5.1 | 7.9 | 1.0 | 9.0 | |
| Propagation delay time (SELECT-Y) | t_{pLH} t_{pHL} | — | 3.3 ± 0.3 | 15 | — | 7.0 | 11.0 | 1.0 | 13.0 | ns |
| | | | | 50 | — | 9.5 | 14.5 | 1.0 | 16.5 | |
| | | | 5.0 ± 0.5 | 15 | — | 4.0 | 6.8 | 1.0 | 8.0 | |
| | | | | 50 | — | 5.5 | 8.8 | 1.0 | 10.0 | |
| 3-state output enable time | t_{pZL} t_{pZH} | R _L = 1 kΩ | 3.3 ± 0.3 | 15 | — | 6.7 | 10.5 | 1.0 | 12.5 | ns |
| | | | | 50 | — | 9.2 | 14.0 | 1.0 | 16.0 | |
| | | | 5.0 ± 0.5 | 15 | — | 3.6 | 6.8 | 1.0 | 8.0 | |
| | | | | 50 | — | 5.1 | 8.8 | 1.0 | 10.0 | |
| 3-state output disable time | t_{pLZ} t_{pHZ} | R _L = 1 kΩ | 3.3 ± 0.3 | 50 | — | 8.6 | 12.0 | 1.0 | 13.5 | ns |
| | | | 5.0 ± 0.5 | 50 | — | 5.7 | 7.9 | 1.0 | 9.0 | |
| Input capacitance | C _{IN} | — | | | — | 4 | 10 | — | 10 | pF |
| Output capacitance | C _{OUT} | — | | | — | 6 | — | — | — | pF |
| Power dissipation capacitance | C _{PD} | (Note) | | | — | 23 | — | — | — | pF |

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

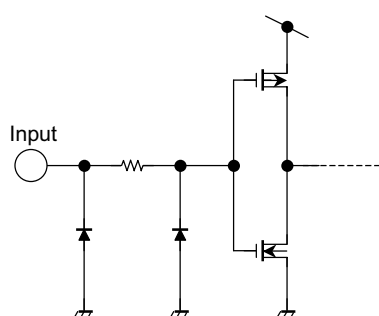
Average operating current can be obtained by the equation:

$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/4 \text{ (per bit)}$$

Noise Characteristics (Input: $t_r = t_f = 3\text{ ns}$)

| Characteristics | Symbol | Test Condition | Ta = 25°C | | | Unit |
|--|------------------|------------------------|---------------------|------|-------|------|
| | | | V _{CC} (V) | Typ. | Limit | |
| Quiet output maximum dynamic V _{OL} | V _{OLP} | C _L = 50 pF | 5.0 | 0.3 | 0.8 | V |
| Quiet output minimum dynamic V _{OL} | V _{OLV} | C _L = 50 pF | 5.0 | -0.3 | -0.8 | V |
| Minimum high level dynamic input voltage V _{IH} | V _{IHD} | C _L = 50 pF | 5.0 | — | 3.5 | V |
| Maximum low level dynamic input voltage V _{IL} | V _{ILD} | C _L = 50 pF | 5.0 | — | 1.5 | V |

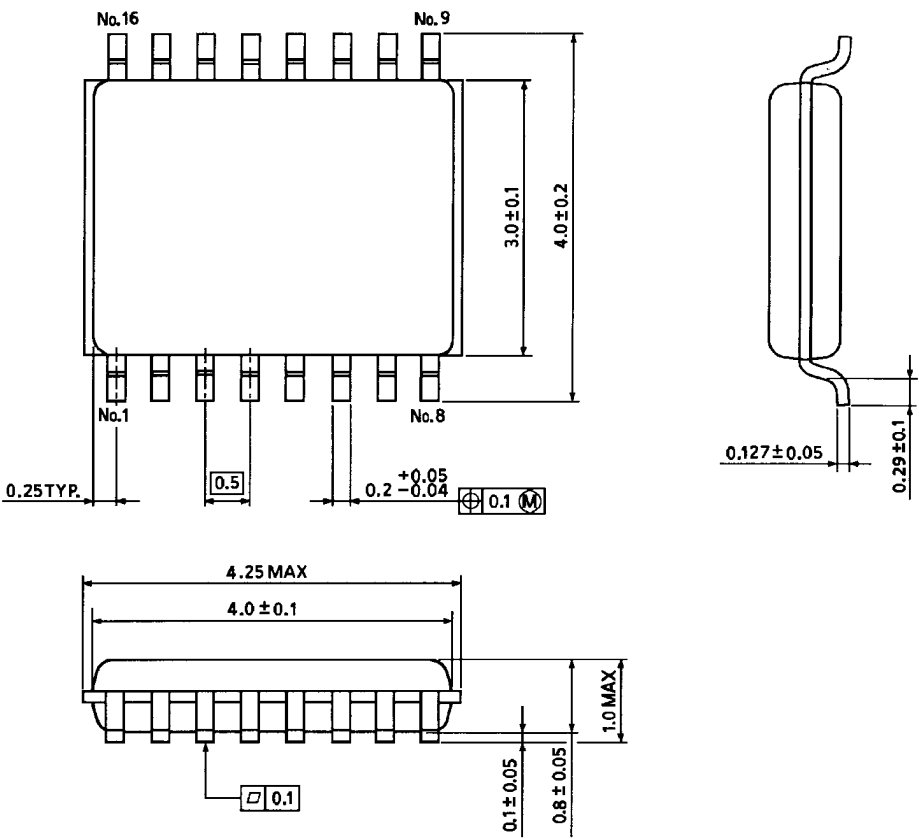
Input Equivalent Circuit



Package Dimensions

VSSOP16-P-0030-0.50

Unit : mm



Weight: 0.02 g (typ.)