

# **OKI** Semiconductor

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## **MSM531632F**

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1,048,576-Word x 16-Bit or 2,097,152-Word x 8-Bit MASKROM

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### DESCRIPTION

The OKI MSM531632F is a high-speed CMOS Mask ROM that can electrically switch between 1,048,576-word x 16-bit or 2,097,152-word x 8-bit configurations. The MSM531622E operates on a single 5.0V power supply and is TTL compatible. The chip's asynchronous I/O requires no external clock assuring easy operation. A power-down mode provides low power dissipation when the chip is not selected. The CE and OE pins are provided as control signals that permit three-stated output allowing easy memory expansion on a system bus. The MSM531622F is suited for use as large capacity fixed memory for microcomputers and data terminals.

### FEATURES

3.0V or 3.3V single power supply

1,048,576-word x 16-bit / 2,097,152-word x 8-bit

Access Time—Current Consumption

150ns—20mA (When power supply is 3.0V±0.3V)

120ns—30mA (When power supply is 3.3V±0.3V)

Tri-state output configurations

Internal powerdown function

Package:

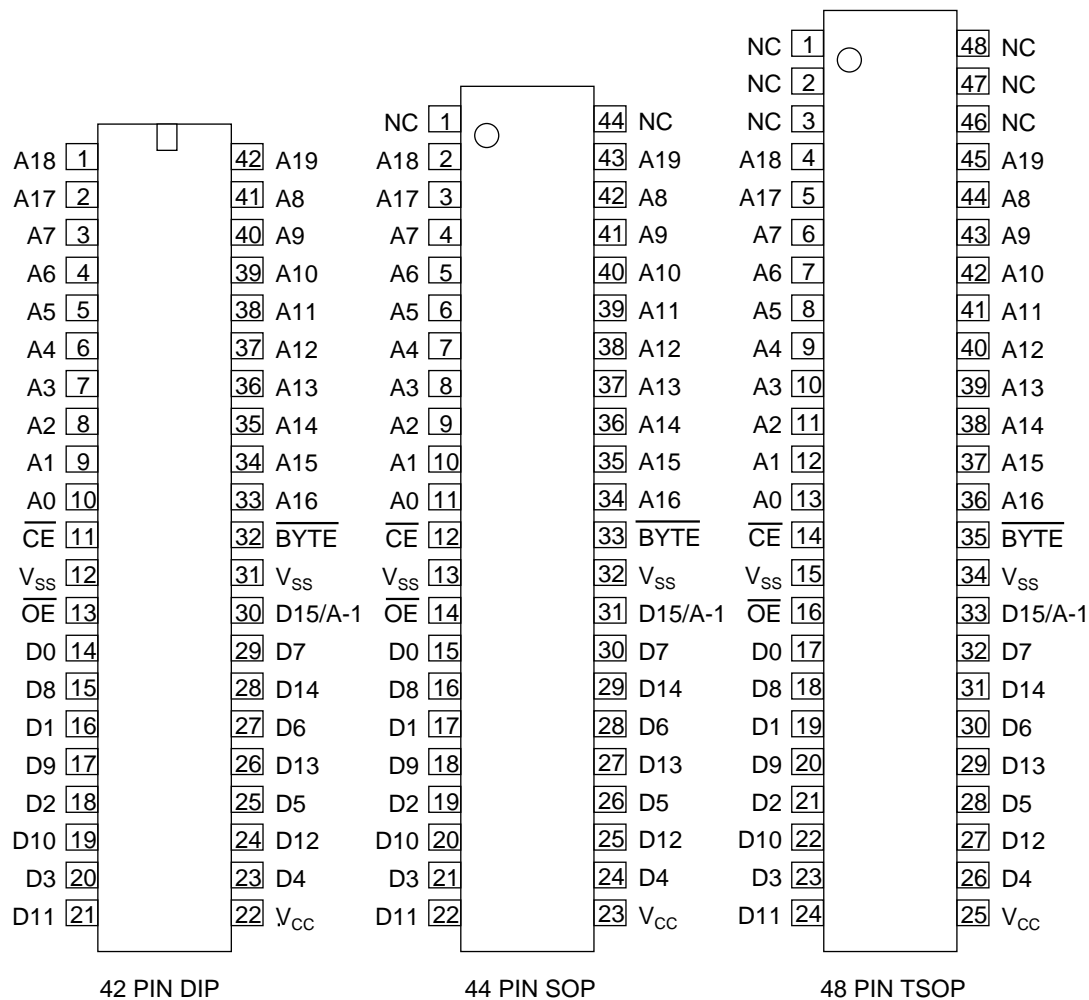
42-PIN PLASTIC DIP (DIP42-P-600) (MSM531632E-xxRS)

44-PIN PLASTIC SOP (SOP44-P-600-K) (MSM531632E-xxGS-K)

48-PIN PLASTIC TSOP (TSOP48-P-550-K) (MSM531632E-xxTS-K)

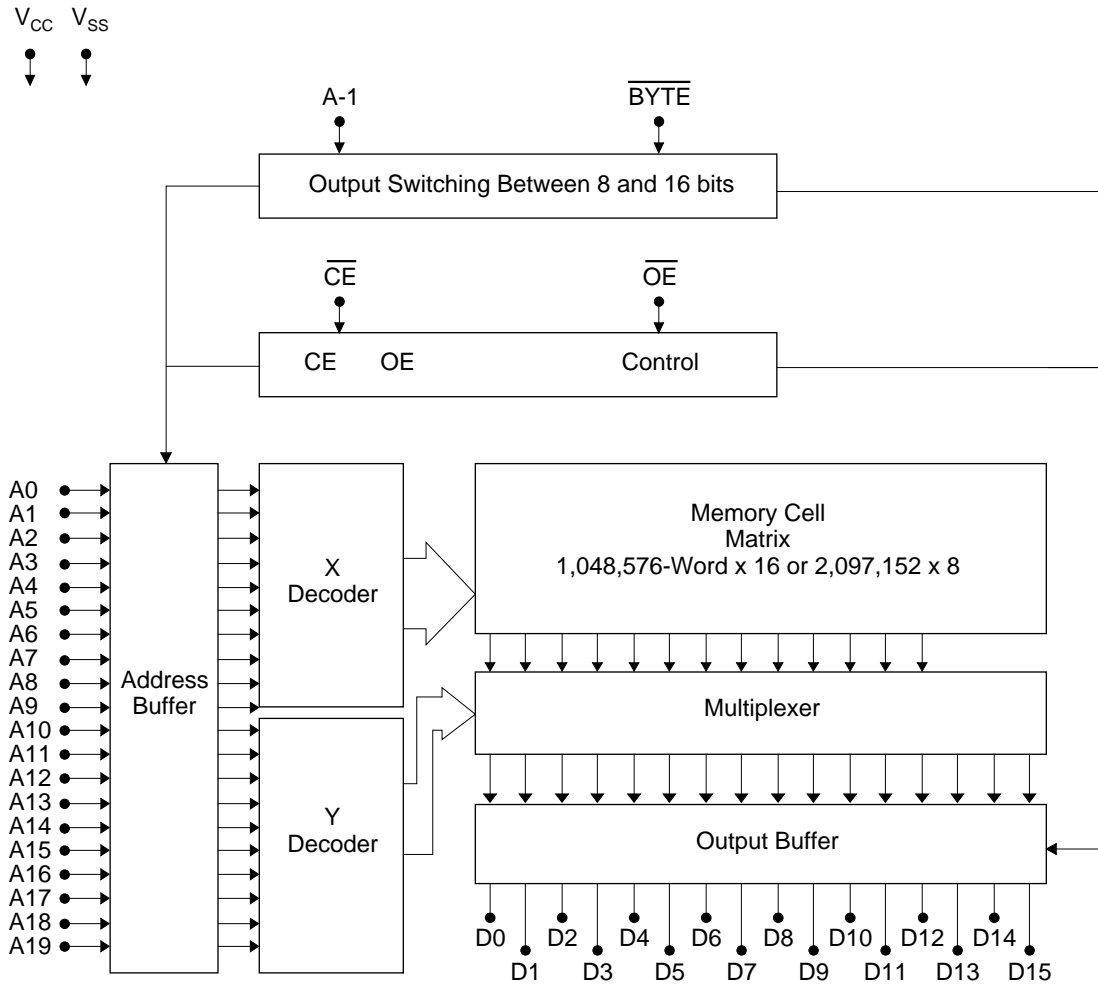
16MEPROM (42-PIN) pin compatible

## PIN CONFIGURATION



| Pin Name                 | Function                    |
|--------------------------|-----------------------------|
| D15/A-1                  | Data output / address input |
| A0 to A19                | Address input               |
| D0 to D15                | Data output                 |
| $\overline{\text{CE}}$   | Chip enable                 |
| $\overline{\text{OE}}$   | Output enable               |
| $\overline{\text{BYTE}}$ | Mode switch                 |
| $V_{CC}$ , $V_{SS}$      | Power supply                |
| NC                       | No Connect                  |

BLOCK DIAGRAM



FUNCTION TABLE

| $\overline{\text{CE}}$ | $\overline{\text{OE}}$ | $\overline{\text{BYTE}}$ | A-1/D15               | D0 to D7  | D8 to D15 | $D_{OUT}$ Mode | LSB    | MSB |
|------------------------|------------------------|--------------------------|-----------------------|-----------|-----------|----------------|--------|-----|
| H                      | X                      | X                        | X                     | Hi-Z      | Hi-Z      | Hi-Z           | —      | —   |
| L                      | H                      | X                        | X                     | Hi-Z      | Hi-Z      |                | 16 bit | A0  |
| L                      | L                      | H                        | Input Inhibited (D15) | D0 to D7  | D8 to D15 | 8 bit          | A-1    | A19 |
| L                      | L                      | L                        | L                     | D0 to D7  | Hi-Z      |                |        |     |
| L                      | L                      | L                        | H                     | D8 to D15 | Hi-Z      |                |        |     |

## ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings

| Parameter             | Symbol    | Conditions                               | Limits                 | Unit             |
|-----------------------|-----------|--|------------------------|------------------|
| Power Supply Voltage  | $V_{CC}$  | to $V_{SS}$                              | -0.3 to 7              | V                |
| Input Voltage         | $V_I$     |  | -0.3 to $V_{CC} + 0.5$ | V                |
| Output Voltage        | $V_O$     |  | -0.3 to $V_{CC} + 0.5$ | V                |
| Power Dissipation     | $P_D$     | Per Package $T_{opr} = 25^\circ\text{C}$ | 1.0                    | W                |
| Operating Temperature | $T_{opr}$ |  | 0 to 70                | $^\circ\text{C}$ |
| Storage Temperature   | $T_{stg}$ |  | -55 to 150             | $^\circ\text{C}$ |

### Recommended Operating Conditions ( $V_{CC}=3.0\text{V}$ )

| Parameter             | Symbol    | Conditions | Limits |      |      | Unit             |
|-----------------------|-----------|------------|--------|------|------|------------------|
|                       |           |            | Min.   | Typ. | Max. |                  |
| Power Supply Voltage  | $V_{CC}$  | —          | 2.7    | 3.0  | 3.3  | V                |
|                       | $V_{SS}$  | —          | 0.0    | 0.0  | 0.0  | V                |
| "H" Input Voltage     | $V_{IH}$  | —          | 2.0    | 3.0  | 6.0  | V                |
| "L" Input Voltage     | $V_{IL}$  | —          | -0.3   | 0.0  | 0.8  | V                |
| Operating Temperature | $T_{opr}$ | —          | 0      | —    | 70   | $^\circ\text{C}$ |

### Recommended Operating Conditions ( $V_{CC}=3.3\text{V}$ )

| Parameter             | Symbol    | Conditions | Limits |      |      | Unit             |
|-----------------------|-----------|------------|--------|------|------|------------------|
|                       |           |            | Min.   | Typ. | Max. |                  |
| Power Supply Voltage  | $V_{CC}$  | —          | 3.0    | 3.3  | 3.6  | V                |
|                       | $V_{SS}$  | —          | 0.0    | 0.0  | 0.0  | V                |
| "H" Input Voltage     | $V_{IH}$  | —          | 2.0    | 3.3  | 6.0  | V                |
| "L" Input Voltage     | $V_{IL}$  | —          | -0.3   | 0.0  | 0.6  | V                |
| Operating Temperature | $T_{opr}$ | —          | 0      | —    | 70   | $^\circ\text{C}$ |

DC CHARACTERISTICS ( $V_{CC}=3.0V\pm 0.3V$ )

(Ta = 0 to 70°C)

| Parameter                        | Symbol      | Conditions                                 | Limits         |      |      | Unit    |
|----------------------------------|-------------|--|----------------|------|------|---------|
|                                  |             |  | Min.           | Typ. | Max. |         |
| "H" Output Voltage               | $V_{OH1}$   | $I_{OH} = -100\mu A$                       | $V_{CC} - 0.1$ | —    | —    | V       |
|                                  | $V_{OH2}$   | $I_{OH} = -400\mu A$                       | $V_{CC} - 0.4$ | —    | —    | V       |
| "L" Output Voltage               | $V_{OL1}$   | $I_{OL} = 100\mu A$                        | —              | —    | 0.1  | V       |
|                                  | $V_{OL2}$   | $I_{OI} = 1.0mA$                           | —              | —    | 0.4  | V       |
| Input Leakage Current            | $I_{LI}$    | $V_I = 0$ to $V_{CC}$                      | -10            | —    | 10   | $\mu A$ |
| Output Leakage Current           | $I_{LO}$    | $V_O = 0$ to $V_{CC}$<br>$CE = V_{IH MIN}$ | -10            | —    | 10   | $\mu A$ |
| Power Supply Current (Operating) | $I_{CC}$    | $CE = V_{IL}, OE = V_{IH}, t_C = 150ns$    | —              | —    | 20   | mA      |
| Power Supply Current (Standby)   | $I_{CCS^C}$ | $CE = V_{CC} - 0.2V$                       | —              | —    | 10   | $\mu A$ |
|                                  | $I_{CCS^T}$ | $CE = V_{IH MIN}$                          | —              | —    | 50   | $\mu A$ |

I DC CHARACTERISTICS ( $V_{CC}=3.3V\pm 0.3V$ )

(Ta = 0 to 70°C)

| Parameter                        | Symbol      | Conditions                                 | Limits         |      |      | Unit    |
|----------------------------------|-------------|--|----------------|------|------|---------|
|                                  |             |  | Min.           | Typ. | Max. |         |
| "H" Output Voltage               | $V_{OH1}$   | $I_{OH} = -100\mu A$                       | $V_{CC} - 0.1$ | —    | —    | V       |
|                                  | $V_{OH2}$   | $I_{OH} = -400\mu A$                       | $V_{CC} - 0.4$ | —    | —    | V       |
| "L" Output Voltage               | $V_{OL1}$   | $I_{OL} = 100\mu A$                        | —              | —    | 0.1  | V       |
|                                  | $V_{OL2}$   | $I_{OI} = 1.0mA$                           | —              | —    | 0.4  | V       |
| Input Leakage Current            | $I_{LI}$    | $V_I = 0$ to $V_{CC}$                      | -10            | —    | 10   | $\mu A$ |
| Output Leakage Current           | $I_{LO}$    | $V_O = 0$ to $V_{CC}$<br>$CE = V_{IH MIN}$ | -10            | —    | 10   | $\mu A$ |
| Power Supply Current (Operating) | $I_{CC}$    | $CE = V_{IL}, OE = V_{IH}, t_C = 120ns$    | —              | —    | 30   | mA      |
| Power Supply Current (Standby)   | $I_{CCS^C}$ | $CE = V_{CC} - 0.2V$                       | —              | —    | 10   | $\mu A$ |
|                                  | $I_{CCS^T}$ | $CE = V_{IH MIN}$                          | —              | —    | 50   | $\mu A$ |

## AC CHARACTERISTICS

## Timing conditions

| Parameter              | Conditions                                     |
|------------------------|--|
| Input Signal Level     | $V_{IH}=3.0V, V_{IL}=0.0V$                     |
| Transition Time        | $t_r=t_f=5ns$                                  |
| Timing Reference Level | Input Voltage=1.5V<br>Output Voltage=0.8V&2.0V |
| Load Condition         | CL=50pF  |

Read Cycle ( $V_{CC}=3.0V\pm 0.3V$ )

(Ta = 0 to 70°C)

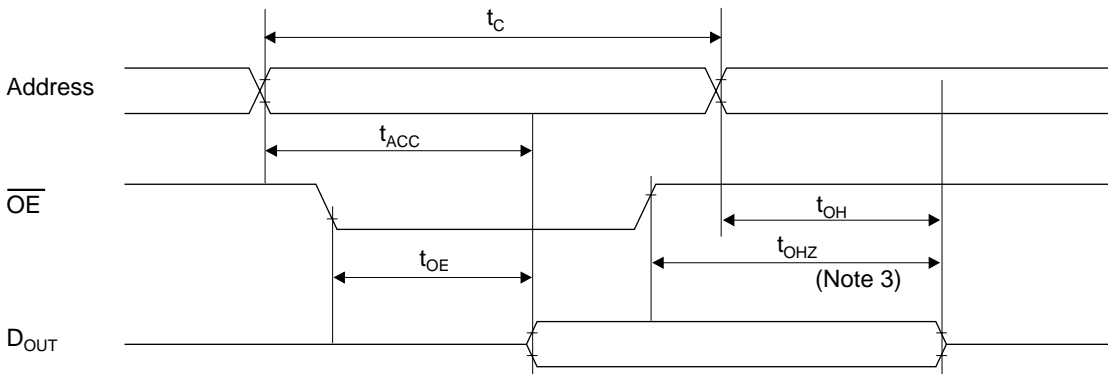
| Parameter              | Symbol    | Conditions | Rated Value |      |      | Unit |
|------------------------|-----------|------------|-------------|------|------|------|
|                        |           |            | Min.        | Typ. | Max. |      |
| Cycle time             | $t_C$     | —          | 150         | —    | —    | ns   |
| Address Access time    | $t_{ACC}$ | —          | —           | —    | 150  | ns   |
| CE Access time         | $t_{CE}$  | —          | —           | —    | 150  | ns   |
| OE Access time         | $t_{OE}$  | —          | —           | —    | 80   | ns   |
| CE Output Disable time | $t_{CHZ}$ | —          | 0           | —    | 70   | ns   |
| OE Output Disable time | $t_{OHZ}$ | —          | 0           | —    | 60   | ns   |
| Output Hold time       | $t_{OH}$  | —          | 0           | —    | —    | ns   |

Read Cycle ( $V_{CC}=3.3V\pm 0.3V$ )

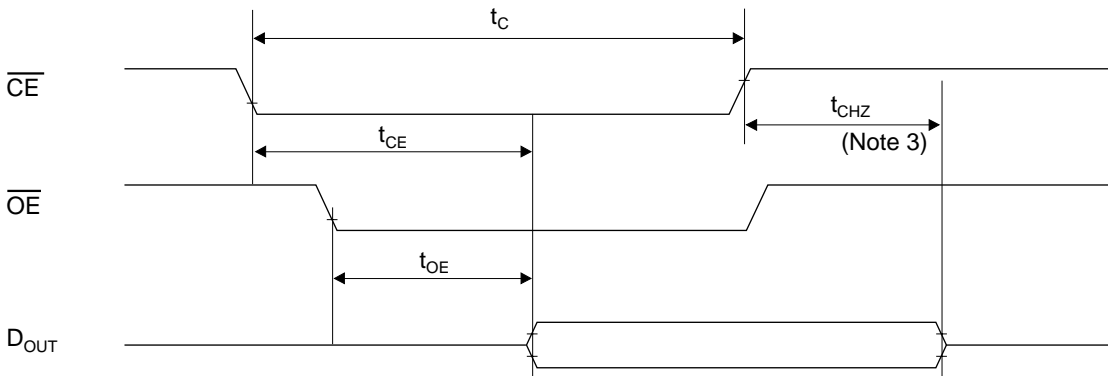
(Ta = 0 to 70°C)

| Parameter              | Symbol    | Conditions | Value |      |      | Unit |
|------------------------|-----------|------------|-------|------|------|------|
|                        |           |            | Min.  | Typ. | Max. |      |
| Cycle time             | $t_C$     | —          | 120   | —    | —    | ns   |
| Address Access time    | $t_{ACC}$ | —          | —     | —    | 120  | ns   |
| CE Access time         | $t_{CE}$  | —          | —     | —    | 120  | ns   |
| OE Access time         | $t_{OE}$  | —          | —     | —    | 70   | ns   |
| CE Output Disable time | $t_{CHZ}$ | —          | 0     | —    | 60   | ns   |
| OE Output Disable time | $t_{OHZ}$ | —          | 0     | —    | 50   | ns   |
| Output Hold time       | $t_{OH}$  | —          | 0     | —    | —    | ns   |

Read Cycle (Note 1)



Read Cycle (Note 2)



- Note )
1. CE is low level.
  2. Address is fixed before or at the same time when CE level falls.
  3.  $t_{CHZ}$  &  $t_{OHZ}$  indicate the time until floating. They are not determined by the output level.

I I/O CAPACITANCE

| Parameter          | Symbol | Conditions | Rated Value |      |      | Unit |
|--------------------|--------|------------|-------------|------|------|------|
|                    |        |            | Min.        | Typ. | Max. |      |
| Input Capacitance  | $C_I$  | $V_I=0V$   | —           | —    | 8    | pF   |
| Output Capacitance | $C_O$  | $V_O=0V$   | —           | —    | 10   | pF   |

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