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NTE2716 Integrated Circuit NMOS, 16K UV Erasable PROM

Description:

The NTE2716 is a 16,384-bit (2048 x 8-bit) Erasable and Electrically Reprogrammable PROM in a 24-Lead DIP type package designed for system debug usage and similar applications requiring non-volatile memory that could be reprogrammed periodically. The transparent lid on the package allows the memory content to be erased with ultraviolet light.

The NTE2716 operates from a single power supply and has a static power down mode.

Features:

- Single 5V Power Supply
- Automatic Power-Down Mode (Standby)
- Organized as 2048 Bytes of 8Bits
- TTL Compatible During Read and Program
- Access Time: 350ns
- Output Enable Active Level is User Selectable

Absolute Maximum Ratings: (Note 1)

| | | |
|--|-------|----------------|
| All Input or Output Voltages (with respect to V_{SS}) | | +6 to -0.3V |
| V_{PP} Supply Voltage (with respect to V_{SS}) | | +28 to -0.3V |
| Temperature Under Bias ($V_{PP} = 5V$) | | -10° to +80°C |
| Operating Temperature Range, T_{opr} | | 0° to +70°C |
| Storage Temperature Range, T_{stg} | | -65° to +125°C |

Note 1. Permanent device may occur if "Absolute Maximum Ratings" are exceeded. Functional operation should be restricted to "Recommended Operating Conditions". Exposure to higher than recommended voltages for extended periods of time could affect device reliability.

Note 2. This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields; however, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high-impedance circuit.

Mode Selection:

| Mode | Pin Number | | | | | |
|-----------------|-------------------|-----------------------|---|------------------|--------------------------|-----------------------|
| | 9–11, 13–17 DQ | 12 V _{SS} | 18 E/Progr | 20 Ḡ (Note3) | 21 V _{PP} | 24 V _{CC} |
| Read | Data Out | V _{SS} | V _{IL} | V _{IL} | V _{CC} (Note 3) | V _{CC} |
| Output Disable | High Z | V _{SS} | Don't Care | V _{IH} | V _{CC} (Note 3) | V _{CC} |
| Standby | High Z | V _{SS} | V _{IH} | Don't Care | V _{CC} | V _{CC} |
| Program | Data In | V _{SS} | Pulsed V _{IL} to V _{IH} | V _{IH} | V _{PPH} | V _{CC} |
| Program Verify | Data Out | V _{SS} | V _{IL} | V _{IL} | V _{PPH} | V _{CC} |
| Program Inhibit | High Z | V _{SS} | V _{IL} | V _{IH} | V _{PPH} | V _{CC} |

Note 3. In Read Mode if $V_{PP} \geq V_{IH}$, then \bar{G} (active low)
 $V_{PP} \leq V_{IL}$, then G (active high)

Capacitance: (f = 1MHz, T_A = +25°C, periodically sampled rather than 100% tested)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|--------------------|------------------|-----------------------|-----|-----|------|------|
| Input Capacitance | C _{in} | V _{in} = 0V | – | 4.0 | 6.0 | pF |
| Output capacitance | C _{out} | V _{out} = 0V | – | 8.0 | 12.0 | pF |

Note 4. Capacitance measured with a Boonton Meter or effective capacitance calculated from the equation: $C = \frac{I\Delta t}{\Delta V}$

DC Operating Conditions and Characteristics: (Full Operating Voltage and Temperature Range unless otherwise specified)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|-----------------------------------|--|------|-----|----------------------|------|
| Recommended DC Read Operating Conditions | | | | | | |
| Supply Voltage | V _{CC} , V _{PP} | Note 5 | 4.75 | 5.0 | 5.25 | V |
| Input High Voltage | V _{IH} | | 2.0 | – | V _{CC} +1.0 | V |
| Input Low Voltage | V _{IL} | | –0.1 | – | +0.8 | V |
| Recommended DC Operating Conditions | | | | | | |
| Address, Ḡ and E/Progr Input Sink Current | I _{in} | V _{in} = 5.25V | – | – | 10 | μA |
| Output Leakage Current | I _{LO} | V _{out} = 5.25V, Ḡ = 5V | – | – | 10 | μA |
| V _{CC} Supply Current (Standby) | I _{CC1} | E/Progr = V _{IH} , Ḡ = V _{IL} | – | – | 25 | mA |
| V _{CC} Supply Current (Active) | I _{CC2} | Outputs Open, Ḡ = E/Progr = V _{IL} | – | – | 100 | mA |
| V _{CC} Supply Current | I _{PP1} | V _{PP} = 5.25V, Note 5 | – | – | 5 | mA |
| Output Low Voltage | V _{OL} | I _{OL} = 2.1mA | – | – | 0.45 | V |
| Output High Voltage | V _{OH} | I _{OH} = –400μA | 2.4 | – | – | V |

Note 5. V_{CC} must be applied simultaneously or prior to V_{PP}. V_{CC} must also be switched off simultaneously with or after V_{PP}. With V_{PP} connected directly to V_{CC} during the read operation, the supply current would then be the sum of I_{PP1} and I_{CC}.

AC Operating Conditions and Characteristics: (Full Operating Voltage and Temperature Range, Note 6, unless otherwise specified)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|------------|---|-----|-----|-----|------|
| Address Valid to Output Valid | t_{AVQV} | $\bar{E}/\text{Progr} = \bar{G} = V_{IL}$ | – | – | 350 | ns |
| \bar{E}/Progr to Output Valid | t_{ELQV} | Note 7 | – | – | 350 | ns |
| Output Enable to Output Valid | t_{GLQV} | $\bar{E}/\text{Progr} = V_{IL}$ | – | – | 150 | ns |
| \bar{E}/Progr to High Z Output | t_{EHQZ} | | 0 | – | 100 | ns |
| Output Disable to High Z Output | t_{GHQZ} | $\bar{E}/\text{Progr} = V_{IL}$ | 0 | – | 100 | ns |
| Data Hold from Address | t_{AXDX} | $\bar{E}/\text{Progr} = G = V_{IL}$ | 0 | – | – | ns |

Note 6. Input Pulse Levels 0.8V and 2.2V
 Input Rise and Fall Times 20ns
 Input and Output Timing Levels 2.0 and 0.8V

Note 7. t_{ELQV} is referenced to \bar{E}/Progr or stable address, whichever occurs last.

DC Programming Conditions and Characteristics: ($T_A = +25^\circ\text{C} \pm 5^\circ\text{C}$)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|--|-------------------|--|------|------|--------------|---------------|
| Recommended Programming Operating Conditions | | | | | | |
| Supply Voltage | V_{CC}, V_{PPL} | | 4.75 | 5.0 | 5.25 | V |
| | V_{PPH} | | 24.0 | 25.0 | 26.0 | V |
| Input High Voltage for Data | V_{IH} | | 2.2 | – | $V_{CC}+1.0$ | V |
| Input Low Voltage for Data | V_{IL} | | –0.1 | – | +0.8 | V |
| Programming Operating DC Characteristics | | | | | | |
| Address, \bar{G} and \bar{E}/Progr Input Sink Current | I_{LI} | $V_{in} = 5.25\text{V}/0.45\text{V}$ | – | – | 10 | μA |
| V_{PP} Programming Pulse Supply Current | I_{PP2} | $V_{PP} = 25\text{V} \pm 1\text{V}, \bar{E}/\text{Progr} = V_{IH}$ | – | – | 30 | mA |
| V_{CC} Supply Current | I_{CC} | Outputs Open | – | – | 160 | mA |

AC Programming Operating Conditions and Characteristics:

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|-------------------------------------|------------|---------------------------------|-----|-----|-----|---------------|
| Address Setup Time | t_{AVEH} | | 2.0 | – | – | μs |
| Output Enable High to Program Pulse | t_{GHEH} | | 2.0 | – | – | μs |
| Data Setup Time | t_{DVEH} | | 2.0 | – | – | μs |
| Address Hold Time | t_{ELAX} | | 2.0 | – | – | μs |
| Output Enable Hold Time | t_{ELGL} | | 2.0 | – | – | μs |
| Data Hold Time | t_{ELQZ} | | 2.0 | – | – | μs |
| V_{PP} Setup Time | t_{PHEH} | | 0 | – | – | ns |
| V_{PP} to Enable Low Time | t_{ELPL} | | 0 | – | – | ns |
| Output Disable to High Z Output | t_{GHQZ} | | 0 | – | 150 | ns |
| Output Enable to Valid Data | t_{GLQV} | $\bar{E}/\text{Progr} = V_{IL}$ | – | – | 150 | ns |
| Program Pulse Width | t_{EHEL} | Note 8 | 1 | – | 55 | ms |
| Program Pulse Rise Time | t_{PR} | | 5 | – | – | ns |
| Program Pulse Fall Time | t_{PF} | | 5 | – | – | ns |

Note 8. If shorter than 45ms (min) pulses are used, the same number of pulses should be applied after the specific data has been verified to ensure that good programming levels have been written.

Programming Instructions:

Before programming, the memory should be submitted to a full ERASE operation to ensure every bit in the device is in the “1” state (represented by Output High). Data are entered by programming zeros (Output Low) into the required bits. The words are addressed the same way as in the READ operation. A programmed “0” can only be changed to a “1” by ultraviolet light erasure.

To set the memory up for Program Mode, the V_{PP} input (Pin21) should be raised to +25V. The V_{CC} supply voltage is the same as for the Read operation and \bar{G} is at V_{IH} . Programming data is entered in 8-bit words through the data out (DQ) terminals. Only “0 s” will be programmed when “0 s” and “1 s” are entered in the 8-bit data word.

After address and data setup, a program pulse (V_{IL} to V_{IH}) is applied to the \bar{E}/Progr input. A program pulse is applied to each address location to be programmed. To minimize programming time, a 2ms pulse width is recommended. The maximum program pulse width is 55ms; therefore, programming must not be attempted with a DC signal applied to the \bar{E}/Progr input.

Multiple NTE2716s may be programmed in parallel by connecting together like inputs and applying the program pulse to the \bar{E}/Progr inputs. Different data may be programmed into multiple NTE2716s connected in parallel by using the PROGRAM INHIBIT mode. Except for the \bar{E}/Progr pin, all like inputs (including Output Enable) may be common.

The PROGRAM VERIFY mode with V_{PP} at +25V is used to determine that all programmed bits were correctly programmed.

Read Operation:

After access time, data is valid at the outputs in the READ mode. With stable system addresses, effectively faster access time can be obtained by gating the data onto the bus with Output Enable.

The Standby mode is available to reduce active power dissipation. The outputs are in the high impedance state when the \bar{E}/Progr input pin is high (V_{IH}) independent of the Output Enable input.

Erasing Instructions:

The NTE2716 can be erased by exposure to high intensity shortwave ultraviolet light, with a wavelength of 2537 angstroms. The recommended integrated dose (i.e. UV-intensity X exposure time) is 15Ws/cm². As an example, using the “Model 30-000” UV-Eraser (Turner Designs, Mountain View, CA 94043) the ERASE-time is 36 minutes. The lamps should be used without shortwave filters and the NTE2716 should be positioned about one inch away from the UV-tubes.

Recommended Operating Procedures:

After erasure and reprogramming of the EPROM, it is recommended that the quartz window be covered with an opaque self-adhesive cover. It is important that the self-adhesive cover not leave any residue on the quartz if it is removed to allow another erasure.

Pin Connection Diagram

