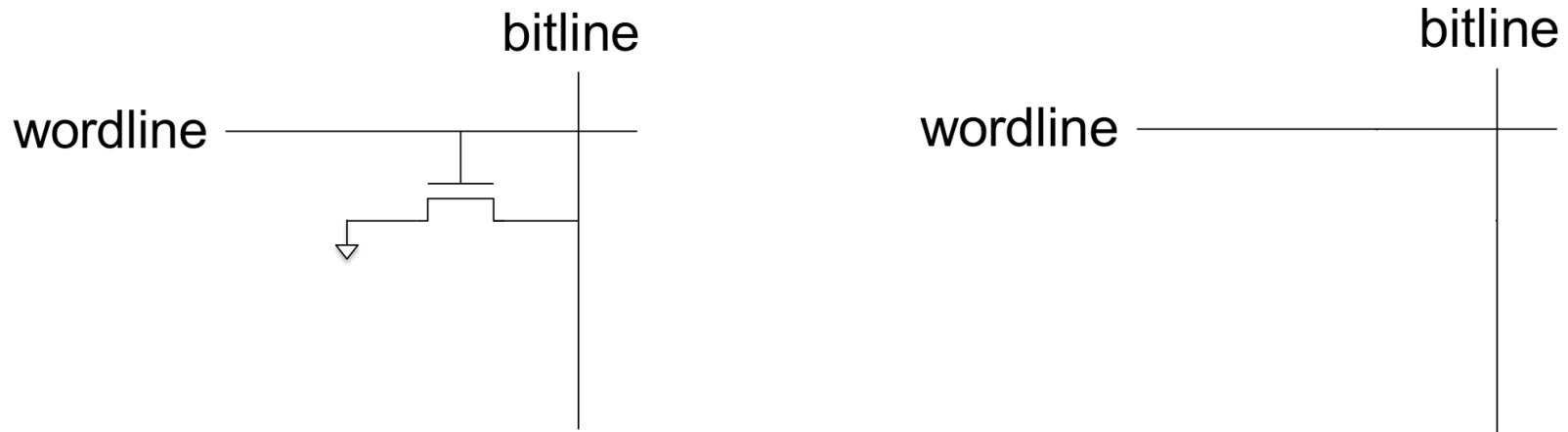




Bits are stored as the presence or absence of a transistor
Bitline is weakly pulled HIGH, then wordline is turned on



Transistor pulls bitline LOW if present (represents 0)
If transistor is absent, bitline remains HIGH (represents 1)
Nonvolatile, does not change if power is turned off

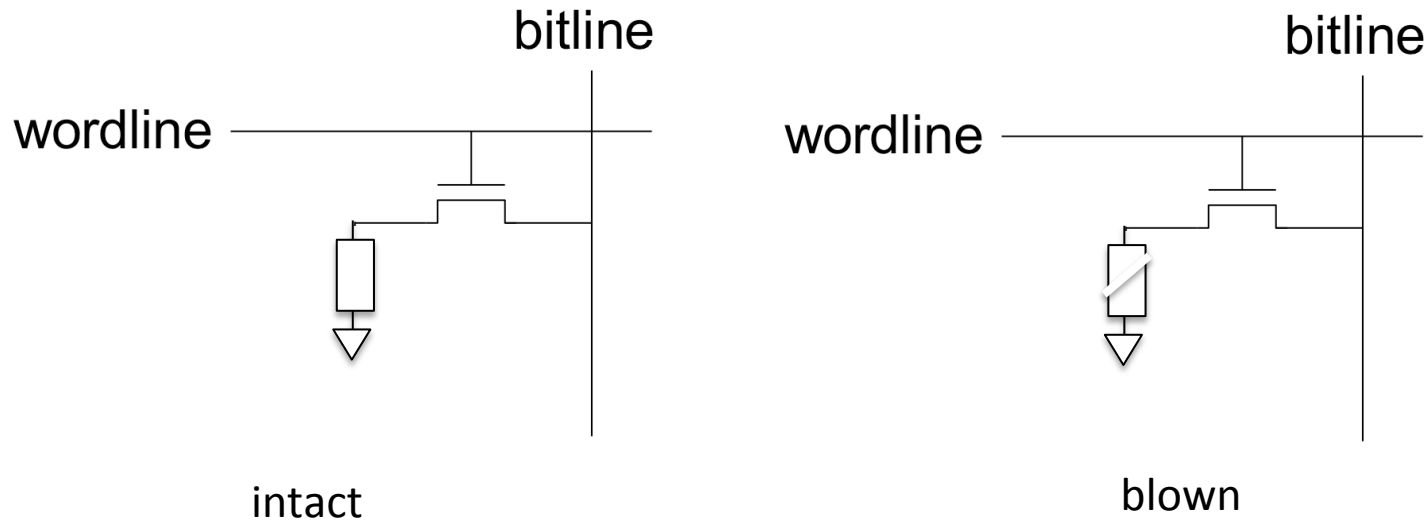
Contents of ROM bit cells can be set during manufacturing by including or omitting a transistor in various cells

These are sometimes called “masked” ROMs

PROMs (programmable ROM) have a transistor in every bit cell provides a way to connect or disconnect each transistor to ground



High voltage is applied to selectively blow the fuse links
Bitline is pulled low if link is in place, otherwise it is high



Transistor pulls bitline LOW if fuse is present (represents 0)
blown fuse disconnects transistor from ground (bitline=1)
These are sometimes called “*one-time programmable*”

Some types of PROM are reprogrammable

- Transistors can be reversibly connected or disconnected to ground

Erasable PROMs (EPROM) use floating-gate transistors

- Electron tunnelling turns on the transistors when voltage is applied

- Exposure to UV light is used to erase the PROMs

- This requires removing the memory chip from its socket

Electrically erasable PROMs (EEPROMs) are erased in place

- EEPROM includes on-chip erasure circuitry

EEPROM bit cells are individually erasable

Flash memory is similar to EEPROM

Flash memory erases larger blocks rather than individual cells

Fewer erasing circuits are required for Flash

This makes Flash less expensive than EEPROM

Flash is a popular way of storing large amounts of data

Used in portable battery-powered cameras and music players

The various types of ROM take longer to write than does RAM