# GRAPHICS

Enhanced Video Display Processor

# V9938C E-VDP

## ■ OUTLINE

V9938 (E-VDP) is a video display processor using an N-channel· silicon gate MOS and a 64-pin shrink DIL plastic package. TMS9918A is software compatible.

## ■ FEATURES

- 5V power supply
- Linear RGB and composite video output
- Built-in palette for displays in up to 512 colors.
- Maximum of 512 x 424 pixels and 16 colors.
- Bit mapped graphics
- A maximum of 256 colors can be displayed at the same time.
- 16 k-byte ~ 128 k-byte display memory
- 16K x 1b, 16K x 4b, 64K x 1b, 64K x 4b DRAMs can be used.
- 256 address, 4ms DRAM auto refresh.
- Expansion video memory can be connected.
- Built-in mouse and light pen interfaces.
- Eight sprites can be displayed for each horizontal line.
- Colors for sprites can be specified for each horizontal line.
- Area move, line, search and other commands.
- Logical operation function.
- Addresses can be specified by coordinates.
- External sync is possible.
- Superimpose is possible.
- Digitize is possible.
- Multi E-VDP configurations are possible.
- Additional external color palettes using the Color-Bus output.

## ■ ELECTRICAL CHARACTERISTICS

### 1. Maximum Ratings

| Symbol | Item | Rating | Unit |
|---|---|---|---|
| Vcc | Power supply voltage | −0.5 ~ +7.0 | V |
| Vin | Input voltage | −0.5 ~ +7.0 | V |
| Ts | Storage temperature | −50 ~ +125 | °C |
| To | Operating temperature | 0 ~ +70 | °C |

### 2. Recommended Operating Conditions

| Symbol | Item | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| Vcc | Power supply voltage | 4.75 | 5.00 | 5.25 | V |
| Vss | Power supply voltage | | 0 | | V |
| TA | Operating ambient temperature | 0 | | 70 | °C |
| VIL 1 | Low level input voltage (group 1) | −0.3 | | 0.8 | V |
| VIL 2 | Low level input voltage (group 2) | −0.3 | | 0.8 | V |
| VIL 3 | External clock low level input voltage (group 3) | −0.3 | | 0.8 | V |
| VIH 1 | High level input voltage (group 1) | 2.2 | | Vcc | V |
| VIH 2 | High level input voltage (group 2) | 2.2 | | Vcc | V |
| VIH 3 | External clock high level input voltage (group 3) | 3.5 | | Vcc | V |

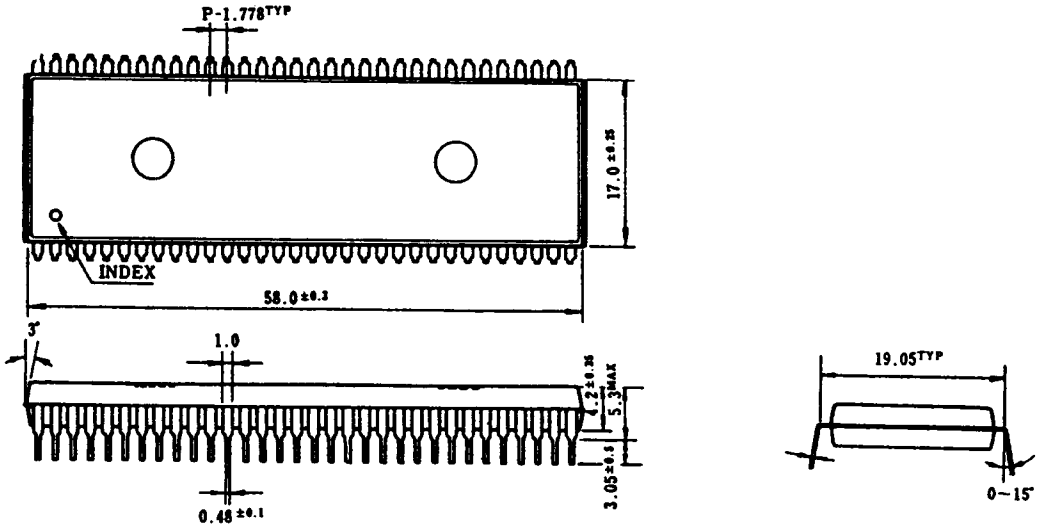
Note: Group 1 $\overline{CSR}$, RDO-7, CO-7, $\overline{LPS}$, $\overline{LPD}$, $\overline{RESET}$, DLCLK
Group 2 CDO-7, MODE 0, MODE 1, $\overline{CSW}$
Group 3 XTAL 1, XTAL 2

### 3. AC Characteristics

| Symbol | Item | Condition | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|---|
| VOL 4 | Low level output voltage (group 4) | IOL = 1.6mA | | | 0.4 | V |
| VOL 5 | Low level output voltage (group 5) | IOL = 1.6mA | | | 0.4 | V |
| VOL 6 | Low level output voltage (group 6) | IOL = 10mA | | | 0.4 | V |
| VOL 7 | Low level output voltage (group 7) | IOL = 1.6mA | | | 0.4 | V |
| VOH 4 | High level output voltage (group 4) | IOH = 100μA | 2.4 | | | V |
| VOH 5 | High level output voltage (group 5) | IOH = 60μA | 2.7 | | | V |
| ILI | In-put leak current | | | | 10 | μA |
| ILO | Output leak current (when floating) | | | | 25 | μA |
| Icc | Current consumption | | | | 230 | mA |

Note: Group 4 CDO-7, RDO-7, ADO-7, $\overline{VDS}$, CBDR, CPUCLK, CO-7
Group 5 $\overline{RAS}$, $\overline{CAS\ 0}$, $\overline{CAS\ 1}$, $\overline{CASX}$, R/$\overline{W}$
Group 6 DLCLK, $\overline{DHCLK}$
Group 7 $\overline{INT}$

## ■ OUTLINE DIMENSIONS




## ■ BLOCK DIAGRAM