PLESSEY
Semiconductors

# MR9710

T-77-07-05

## TELEVIEW DATA ACQUISITION CHIP

The MR9710 Data Acquisition (DA) chip is one of the set of LSI devices comprising the Plessey Semiconductor Teleview (Teletext/Viewdata) system. It receives data from a TV signal or Telephone Line via an appropriate interface and processes the data accordingly. Under instruction from a control device it acquires the requested data and loads it into the correct location in the preselected page store. Control information extracted from the incoming data is provided to the Teleview system.

The device is fabricated in Plessey Semiconductor N-channel metal gate MOS process providing direct TTL interfacing, high speed and good reliability. It is supplied in a 40 lead dual-in-line package.

### FEATURES

- Processes Teletext and Viewdata Input Data
- Direct Interface with Teleview Highways
- Direct Interface with Standard UAR/T
- TTL Compatible Serial Teletext Data Input
- Full Checking of Teletext Data including Parity, Hamming and Data Frequency
- 'Don't Care' Digit Facility
- Non-used Viewdata Control Codes made available to Control Processor.
- Addresses Up To Eight Page Stores

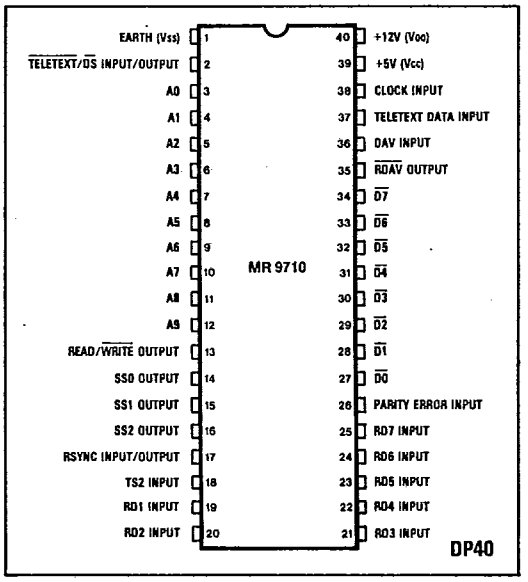


*Fig.1 Pin connections - top view*

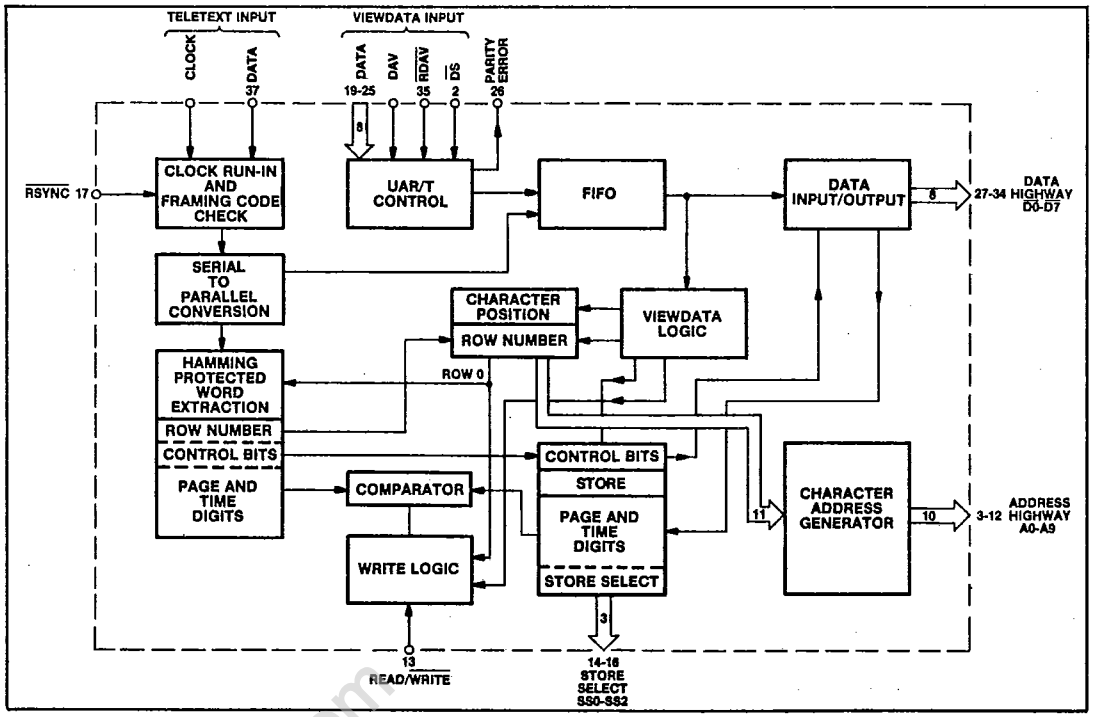


*Fig.2 MR9710 block diagram*

PIN FUNCTIONS

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| Pin Number | Name | Function |
|---|---|---|
| 1 | Vss | This is the negative supply for the device and the reference for all signals and electrical parameters. |
| 2 | $\overline{\text{TELETEXT}}/\overline{\text{DS}}$ INPUT/OUTPUT | When strapped to earth (low level), the DA chip will process Teletext. In Viewdata it is the data strobe output to the UAR/T (active low). |
| 3–12 | A0 to A9 | The 10 bits of address connected to the Address Bus of the Teleview system. As outputs they are tristate and active push-pull for high speed driving the store. They are also inputs to enable the device to be addressed. |
| 13 | Read/$\overline{\text{Write}}$ Output | The read/write control of the page Stores. The Stores will output data (read) when this signal is high. |
| 14–16 | SS0–SS2 Outputs | Three bits of Store Select code enabling one of the eight page Stores. |
| 17 | $\overline{\text{RSYNC}}$ Input/ Output | A low going pulse indicates to the DA the start of a Teletext line. The DA will output a low going pulse within a few microseconds to re-synchronise the Data Slicer. |
| 18 | TS2 Input | The second of the two time slot bits which, when true, indicates that the DA may use the Data and address highways. |
| 19–25 | $\overline{\text{RD1}}$–$\overline{\text{RD7}}$ Inputs | Received Data taken directly from the UAR/T. |
| 26 | Parity Error Input | The Parity error signal from the UAR/T. |
| 27–34 | $\overline{\text{D0}}$–$\overline{\text{D7}}$ | Data I/O's for connection directly to the Teleview Data highway. As an output the active state is low and there is a passive pull-up on chip so that the signals on the highway may be 'wire-ored'. |
| 35 | $\overline{\text{RDAV}}$ Output | Low active signal to the UAR/T which will reset its data available output. |
| 36 | DAV Input | The Data Available signal from the UAR/T to indicate a character is available at the RD1–RD7 pins. |
| 37 | Teletext Data Input | Serial data input from a Data Slicer (e.g. SL9100). TTL compatible. If not used this input should be held low. |
| 38 | Clock Input | Normally the Teletext clock running at 6.9375 MHz and synchronised to the Teletext data by $\overline{\text{RSYNC}}$. In Viewdata only applications a 6MHz clock as used by the Video generator may be input here. TTL compatible. |
| 39 | Vcc | Connected to +5V. This has a low current requirement and is used mainly for the output drivers. |
| 40 | Vdd | Connected to +12V, the main positive supply for the device. |

## OPERATION

The Data Acquisition (DA) chip takes data from either the TV (Teletext) or telephone line (Viewdata) via the appropriate interface, processes it accordingly to type and user requests and loads the display data in the correct position in one of eight page Stores.

The processing of Teletext and Viewdata information is described in separate sections as is the interchange of data with the rest of Teleview system.

## TELETEXT

If pin 2 is held low the DA may receive data via the serial Teletext data input.

While TS2 is true the DA will monitor $\overline{\text{RSYNC}}$ and the address highways. If a pulse appears on $\overline{\text{RSYNC}}$ it will process a Teletext data-line. At other times while TS2 is true it will respond to signals on the address highway and interchange data with a Control Device.

While TS2 is false the DA will do nothing.

## TELETEXT DATA RECEPTION

Data is extracted from the TV video signal by an external circuit called the Data Slicer. This circuit provides a serial data signal and a clock to the DA's input.

A 0.5$\mu$sec negative pulse generated by the MR9735 Video Generator will appear on the $\overline{\text{RSYNC}}$ line just before the data on a possible Teletext line. This pulse stops the clock in the low state and primes the MR9710 to monitor the Teletext Data Input for clock run-in. The first negative transition restarts the clock which is used as a reference against which to compare the incoming signal. If the frequency is correct the MR9710 outputs a second $\overline{\text{RSYNC}}$ pulse which allows accurate resynchronisation of the clock for the rest of the Teletext line. If the frequency check fails the MR9710 goes back to its idle state waiting for a new $\overline{\text{RSYNC}}$ signal or the Data Interchange time.

After a valid clock run-in has been detected Teletext data is clocked into a serial to parallel converter and Framing Code detector. A time out will cause DA to go idle, while the detection of Framing Code will byte synchronise the S–P converter and start the DA receiving the Teletext data as shown in Fig.3.

The first two words following the Framing Code have data protected by Hamming Code and the appropriate

checks and corrections are performed. If the row address indicates that the data is a Page Header (Row 0) then the following 8 words are also processed by the Hamming Code circuit. If any Hamming Code fails such that it cannot be corrected, then that data line is rejected.

Requests for pages of Teletext data are input to the DA during the Data Interchange periods, described later. When a new page is selected the Page and Time store in the DA is loaded with all '1's indicating 'don't care' digits. As keys are pressed by the user of the Teleview system the values are loaded into the DA in the appropriate position.

A comparator in the DA compares Magazine, Page and Time digits one at a time as they are received in the data stream with the digits stored. The comparator will give a true output if the digit compares exactly or if the stored digit is all 1 (value 15). Where an incoming digit has a range less than 4 bits, e.g. time hours tens has the range 0-3 or 2 bits, the unused bits will be made to compare.

Every line of data received is checked for comparison on Magazine number. If this does not compare and the row address indicates that the row is not a Page Header then that row is rejected.

If the Magazine number does not compare and it is a Page Header then, with the exception of Rolling Headers, it is again rejected.

From the time that the DA is told that the P key has been pressed until the selected page has been captured for the first time all Page Headers that compare on Magazine number are loaded into the Store except those with the Interrupted Sequence bit (C9) set. This mode of display is referred to as Rolling Headers and provides an indication to the user that data is being received. During this mode the Magazine Serial bit (C11) will over-ride the Magazine comparison. A page of data may be captured when the page number has been fully enetered, i.e. the 3rd digit has been received or the T key has been pressed, and a Page Header is received whose Magazine, page and time digits compare with those stored in the DA. That header and all subsequent data lines with correct Magazine number will be stored up to and excluding the next Page Header of correct Magazine number. A 'Page being received' indication will be set at this time for transmission to the Control device.

When a Page Header is received that fully compares the Control bits accompanying that Header will be stored for subsequent transmission to the Control.

When the content of a data line is ready to be stored that data is loaded into the appropriate Store as defined by the signal from the Control device. Its position in the Store is defined by the Row Address of that data line, the location of the first character being 40 times the Row Address (with the exception of the Page Header which does not have the first 8 characters), with following characters being stored in the next 39 locations of Store.

Each character is checked for odd parity and if the check fails that character is not written. The write signal is removed to avoid overwriting a possible valid character already existing in Store.

The last eight characters of every Page Header contain the current clock time and are always written to Store.

## VIEWDATA

With pin 2 connected to the Data Strobe input to a UAR/T and not held to earth the DA will process Viewdata.

While TS2 is true the DA is active as far as the Teleview highways are concerned and it will monitor $\overline{\text{RSYNC}}$ and the Address highway.

When an $\overline{\text{RSYNC}}$ pulse appears the DA will process any Viewdata character it has available. Whenever it is not processing characters it may receive characters asynchronously from the telephone line, via the exclusive connection to the UAR/T, and store them within the DA. Up to three characters may be received and stored before the next processing period when they may be loaded into the page store. Data Interchange with the Teleview system may occur when TS2 is high.

## ASYNCHRONOUS DATA RECEPTION T-77-07-05

The standard UAR/S (MR1015D) will convert the serial data received via the modem to parallel data for inputting to the DA and indicate a character is ready by the data available (DAV) line. At any time, except when actually processing previously received characters, the DA will read the data and acknowledge on $\overline{\text{RDAV}}$, a minimum of 3$\mu$sec after the DAV signal.

## VIEWDATA CHARACTER PROCESSING

The eight bit input consists of seven bits of data plus a parity fail indication. The codes are shown in Fig.4.

Characters intended for storage are loaded into the Store in a location determined by the Character Address counter which is always arranged to point to the position in Store into which the next character will be written. The counter is manipulated by the Control Characters appearing in Cols. 0 and 1 in the character table.

0/8, Back Space, will cause the Character Address counter to be decremented by one.

0/9, Horizontal Tab, will cause the Character Address counter to be incremented by one.

0/10, Line Feed, will increment by 40.

0/11, Vertical Tab, will decrement by 40.

0/12, Form Feed, will reset to zero.

0/13, Carriage Return, will position the Character Address counter to the beginning of the current block of 40.

0/14, Cursor Home, will reset to zero.

A character in columns 2-7 will be written into the appropriate Store at the location indicated by the Character Address counter which will then be incremented by one.

The ESC character (1/11) will cause some modification of the following character as follows:-

If the character is in cols. 4 or 5 it will be written to Store with the most significant bit changed to Zero.

If the character is in col. 3 it will not be written to Store but made ready for transmitting to the Control device.

Any other characters, except NUL, will cancel the ESC sequence and be ignored.

The Form Feed character (0/12) will cause the F bit to be set in the appropriate DA to Control signalling word.

All other control characters in cols. 0 and 1, except NUL, will be sent to the Control at the appropriate time.

If any character has the parity fail indication set then the character 7/15 will be written to Store. At the start of a processing period (i.e. at $\overline{\text{RSYNC}}$) if a character is available for processing then the DA will erase the Cursor bit by reading the location pointed to by the Character.

Address counter and re-write it. Since the DA never writes the 8th bit in the Store the cursor will be removed.

## DATA INTERCHANGE

During the DA's active period, indicated by TS2, when it is not performing any data processing then it will monitor the Address highway for the following codes:

1111XXXX0X indicates the DA should receive data from the data highway.

1111XXXXX0 indicates that the DA should send data to the data highway.

1111X0XXXX indicates that the DA should provide control to the UAR/T.

In the Receive mode the Control device may send data according to the codes in Table 1. The most significant bit of the data acts as a strobe which will cause the other 7 bits to be received and stored in the DA. Magazine, Page and Time digits will be stored in the appropriate location in the digit store, the Store Select number will be stored for use when accessing the Store and the indications of P and T keys being processed will also be latched for use in the processing period.

The receiving of data from the Control is completely asynchronous to the DA's internal clock and is controlled entirely by the Strobe bit.

The Send mode will cause the DA to apply the first code, shown in Table 2, to the data highway. When the code has been read by Control the signal will be acknowledged by Control forcing all 1's (low levels) which will step the DA onto the second word and so on. The Strobe bit is used in this case to indicate that the data is appearing for the first time and once read by Control, is cleared until new data is available. The exception is the first word which always has the Strobe set.

The UAR/T control is recognised by the DA since it has the UAR/T connections and in this mode a Strobe on the data highway will cause the DA to provide a data strobe $\overline{DS}$ to the UAR/T.

During the Data Interchange period the DA will monitor the Store Select lines and if they are all taken low it will output the current content of the Character Address counter to the address highway so that the Control may know where to insert the cursor.

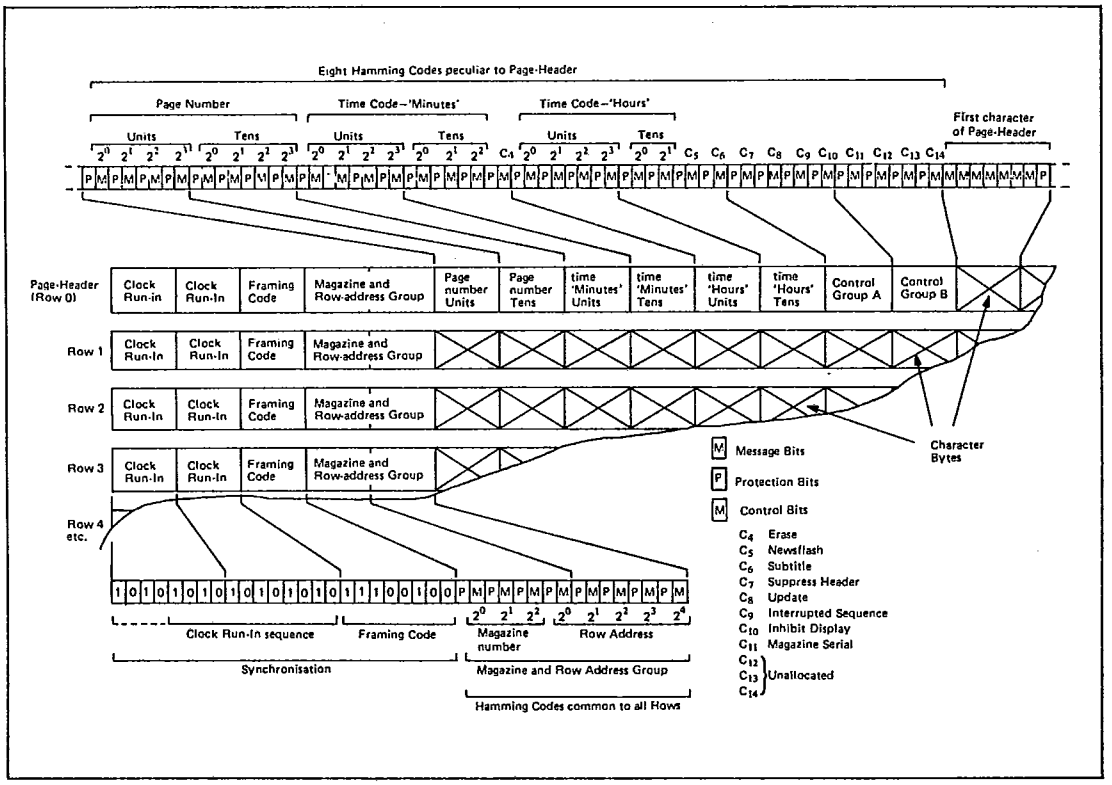


*Fig.3 Synchronisation and Hamming codes at start of page-header and row transmission*

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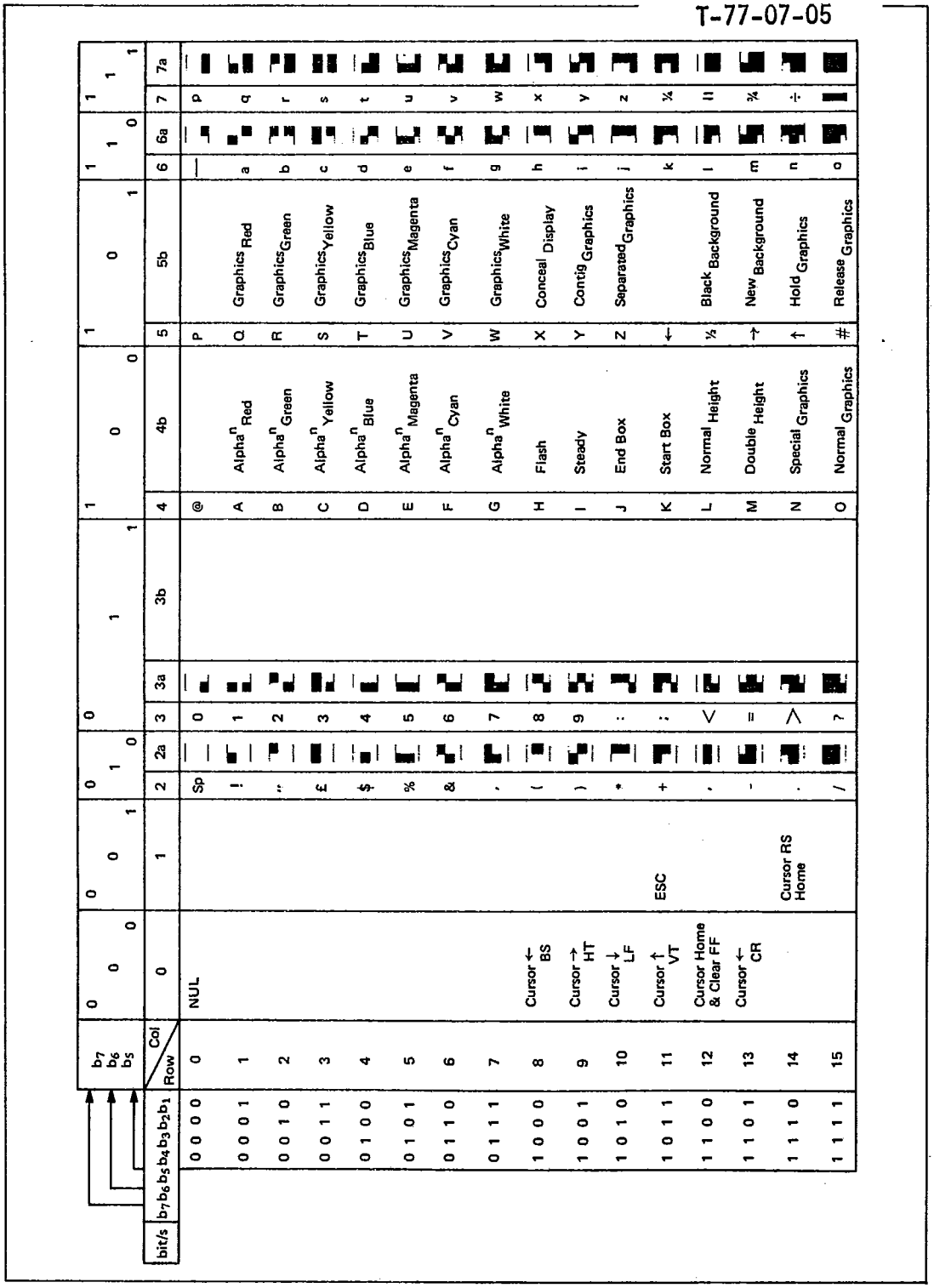


*Fig.4 Viewdata transmission codes recognised by the MR9710*

## CONTROL TO DATA ACQUISITION SIGNALLING

Active low signalling, most significant bit is a strobe.

| | | |
|---|---|---|
| Highway Free | | 0000 0000 |
| Magazine Number | | 1000 Dddd |
| Page Number, | tens | 1001 Dddd |
| | units | 1010 Dddd |
| Store Select | | 1011 0Sss |
| Key Pressed | | 1011 10Kk |
| Spare Code | | 1011 1100 |
| Spare Code | | 1011 1101 |
| Spare Code | | 1011 1110 |
| Dummy Code | | 1011 1111 |
| Time Hours, | tens | 1100 Dddd |
| | units | 1101 Dddd |
| Minutes, | tens | 1110 Dddd |
| | Units | 1111 Dddd |

Where Kk is key identification:

| | |
|---|---|
| P | 00 |
| T | 01 |
| Spare 1 | 10 |
| Spare 2 | 11 |

*Table 1*

Sss is store select number, 000 to 111.

Dddd, Digit key value, initially values 0–9 and 15 used although any value may be sent. For Teletext the magazine range is 0–7, Time hours tens range 0–3, Time minutes tens range 0–7. In addition digit 15 is recognised by the DA as a 'don't care' digit causing automatic comparison.

## DATA ACQUISITION TO CONTROL SIGNALLING

Active low signalling, most significant bit is a strobe. Signals acknowledged by the Control forcing all ones. Control word 1 is sent first and is always sent.

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| | | | | | | |
|---|---|---|---|---|---|---|
| Control word 1 | | 1000 | T | S | s | s |

Where T is the Teletext bit, 1 = Teletext.

S s s is the Store Select number the DA is currently using.

Control words 2–4 depend on whether Teletext or Viewdata is being processed.

**TELETEXT**

| | | | | | | |
|---|---|---|---|---|---|---|
| Control word | 2 | 1001 | PBR | C4 | C6 | C5 |
| | 3 | 1010 | C10 | C9 | C8 | C7 |
| | 4 | 1011 | C14 | C13 | C12 | C11 |

Sent* only when Valid Header received.

PBR is set while a page is being received.

C4 to C14 are the Teletext Control bits.

**VIEWDATA**

| | | | | | | |
|---|---|---|---|---|---|---|
| Control word | 2 | 1001 | X | F | 0 | 0 |
| | 3 | 1010 | b7 | 0 | b6 | b5 |
| | 4 | 1011 | b4 | b3 | b2 | b1 |

Sent* only when a Control character received by DA.

F is set when Form Feed character processed.

b1–b7 are the 7 bits comprising the Viewdata Character.

*Table 2*

*NOTE: that 'sent' means the Strobe bit is set. The other seven bits are actually put onto the highway at the request of the Control and may be used if appropriate (page being received, for example).

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## ELECTRICAL CHARACTERISTICS

**Maximum Ratings**

| | |
|---|---|
| Voltage on any pin with respect to Vss | −0.3V to +15V |
| Storage Temperature | −55°C to +150°C |

Exceeding these ratings could cause permanent damage. Functional operation is not guaranteed under these conditions, the operating ranges are specified below.

**Operating Conditions**

| | |
|---|---|
| Supply Voltages | VSS = 0V (substrate voltage)<br>VCC = +5V ± 5%<br>VDD = +12V ± 10% |
| Temperature Range | 0°C to +70°C |

| Characteristic | Min | Typ | Max | Units | Conditions |
|---|---|---|---|---|---|
| **OUTPUTS** | | | | | |
| **Address Outputs** (tri-state) | | | | | |
| High level | +2.4 | | Vcc | V | Ioh = −320μA |
| Low level | | +0.2 | +0.45 | V | Iol = 3.2mA |
| Capacitance | | | 15 | pF | V = 0V |
| T rise, T fall | | | 200 | ns | C load = 100pF |
| Leakage, high impedance state | | | 5 | μA | V out = 0V or +5V |
| **Data Outputs** (passive pull-up) | | | | | |
| High Level | +2.4 | | Vcc | V | Ioh = −1.5mA |
| Low Level | | +0.2 | +0.45 | V | Iol = 3.2mA |
| Capacitance | | | 15 | pF | V out = 0V |
| **$\overline{R/W}$ and Store Select Outputs** | | | | | |
| High Level | +2.4 | | Vcc | V | Ioh = −320μA |
| Low Level | | +0.2 | +0.45 | V | Iol = 3.2mA |
| Capacitance | | | 15 | pF | V out = 0V |
| Current sourced, 'off' state | 1.2 | | 2.6 | mA | V out = 0V |
| **$\overline{RDAV}$ and $\overline{DS}$ Outputs** | | | | | |
| High Level | +2.4 | | Vcc | V | Ioh = −25μA |
| Low Level | | +0.2 | +0.45 | V | Iol = 100μA |
| Capacitance | | | 15 | pF | V out = 0V |
| **$\overline{RSYNC}$ Output (Open Drain)** | | | | | |
| Low Level | | +0.2 | +0.45 | V | Iol = 4mA |
| Leakage, output off | | | 10 | μA | V out = +12V |
| **INPUTS (except Clock and Teletext Data)** | | | | | |
| High Level | 2.2 | | Vdd | V | |
| Low Level | Vss | | +0.8 | V | |
| Leakage (except I/O's) | | | 10 | μA | V = +12V |
| Input Capacitance | | | 15 | pF | V in = 0V |
| **Clock and Teletext Data Inputs** | | | | | |
| High Level | 2.8 | | Vdd | V | |
| Low Level | Vss | | 0.4 | V | |
| Capacitance | | | 20 | pF | V in = 0V |
| Leakage | | | 10 | μA | V in = +12V |
| Frequency | 1.0 | | 7.5 | MHz | |
| **POWER** | | | | | |
| Vcc Supply Current | | | 15 | mA | Vcc = +5.0V |
| Vdd Supply Current | | | 72 | mA | Vdd = +12V (at 25°C) |