TEXAS INSTRUMENTS

Consumer Products Family

UNIVERSAL TELETEXT SYSTEMS
Teletext Decoder EUROTEXT
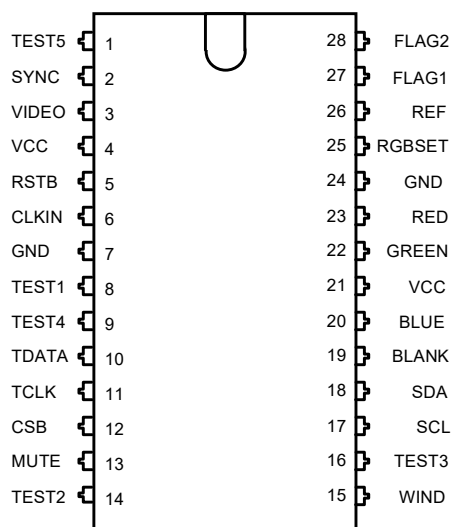# CF70210

Draft 1E

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- **Eight pages of on-chip display RAM**

- **Hebrew Language**

- **Automatic FLOF & TOP decoding**

- **Flicker-free packet 26 processing on chip**

- **Program delivery control (PDC)**

- **Minimum software requirement**

- **Menu page capability**

- **Instantaneous page memory clear**

- **75Ω Direct Drive RGB outputs**

- **Digital PLL**

- **Upgrade path from UNITEXT**

- **Direct access to subtitles**

- **Flexible packaging options: 28 DIL, 44 PLCC**


CF70210 - 28 pin DIL

1.0 DESCRIPTION

The CF70210 EUROTEXT device is an eight page intelligent teletext decoder for use with 625 line TV transmissions having teletext in the Vertical Blanking Interval (VBI). When used with an Analogue Interface device (Texas Instruments' CF72306 or CF72416), it provides a flexible teletext solution incorporating internal software to implement FLOF and TOP teletext decoding automatically.

Eurotext supports a comprehensive range of 29 West and East European languages in a single device. A full list is shown on Page 13. Other devices are available in this family of teletext devices that will support Cyrillic and Latin languages and VPS data capture/decoding and WSS data capture(Table 1).

CF70210 - 44 pin PLCC

On-chip processing of packet 26 characters (flicker free) is automatically implemented as required. All packets of type 26 are processed in 'real time' without the need for any additional memory. This allows the decoder to store eight pages of teletext irrespective of the mode of operation. On-chip is an 11.5 MIPs micro-coded processor which controls all the teletext processing requirements, including ghost row processing and TOP table processing. All teletext data is processed in 'real time'.

The control of the device is by high level simple commands for all features.

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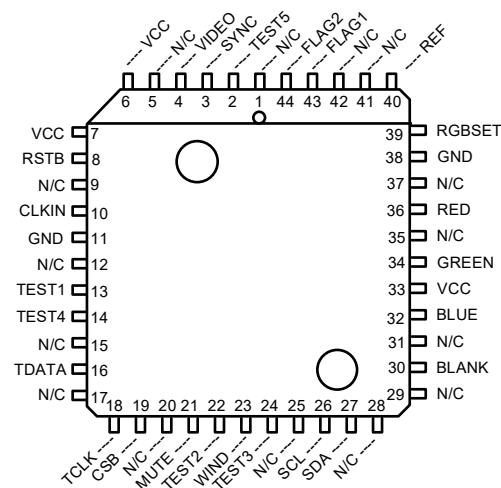
1.0 Description (Continued)

The pin out and software commands have been designed to use either UNITEXT or EUROTEXT chips without any modification to the hardware or software, allowing a single, four or an eight page decoder to share the same PCB and controlling software.

In addition to the FLOF and TOP modes the EUROTEXT decoder has a default Normal mode for any TV channel that is not transmitting FLOF or TOP. The decoder is ideally suited to VCR applications as it is able to receive and decode PDC information from packets 26 and 8/30 and store this information inside the decoder. In this mode of operation, memory can also be assigned for menu pages (pages downloaded from main microprocessor).

1.1 Eurotext Family of Devices.

Other teletext devices are available in the Eurotext family. These devices are all hardware and software compatible with the CF70210 device.

Part Number	VPS	Memory On-chip	Languages
CF70200	No	8 Pages	Western and Eastern European
CF70203	Yes	8 Pages	Western and Eastern European
CF70204/5	No	4 Pages	Western and Eastern European
CF70209	No	8 Pages	Russian, Ukrainian, English
CF70210	No	8 Pages	Hebrew
CF70211	Yes	8 Pages	Latin and Cyrillic

Table 1: Eurotext Family of Devices.

2.0 PAGE CAPTURE MODES

The EUROTEXT decoder can operate in four main modes of operation depending upon the transmitted teletext signal and the controlling microprocessor. These modes are:

> Normal
> FLOF
> TOP
> Favourite Page

In EUROTEXT, the on-chip processor will automatically select the pages to be stored in memory in all modes of operation except Favourite Page mode. EUROTEXT will implement an efficient page capture algorithm which will ensure that only one version of any page is stored in the memory and that all the pages will be kept updated with the latest data. When a page is received with the clear page bit set, or the page is received for the first time, the decoder will clear the relevant page store instantaneously. This allows the decoder to receive teletext signals using 'advanced page headers' or 'magazine shuffle'.

In addition to the four main modes of operation, the decoder has two additional modes of operation:

> Menu Page
> Sub Page.

In the Menu Page mode, the page stores 6 and 7 can be redefined as either two menu pages or as one menu page and one page as a store for non-display packets. This mode allows the chip to be used for PDC applications.

In the Sub Page mode, the decoder will capture the next two sub-pages of the display page.

In all modes, Teletext pages containing sub-titles can be directly selected.

The four modes of operation can be either selected directly or EUROTEXT can be set into an auto mode. In auto mode, after a channel change command, the decoder will initially be in normal mode. If a packet 27 designation code 0 for the display is received, the decoder will switch to FLOF mode. If the decoder is in normal mode and receives a basic TOP table, it will switch to TOP mode.

In all modes of operation, the row 24 display can be either generated on-chip or can be written to by the external microprocessor. The external microprocessor can also disable the display of row 24.

2.0 PAGE CAPTURE
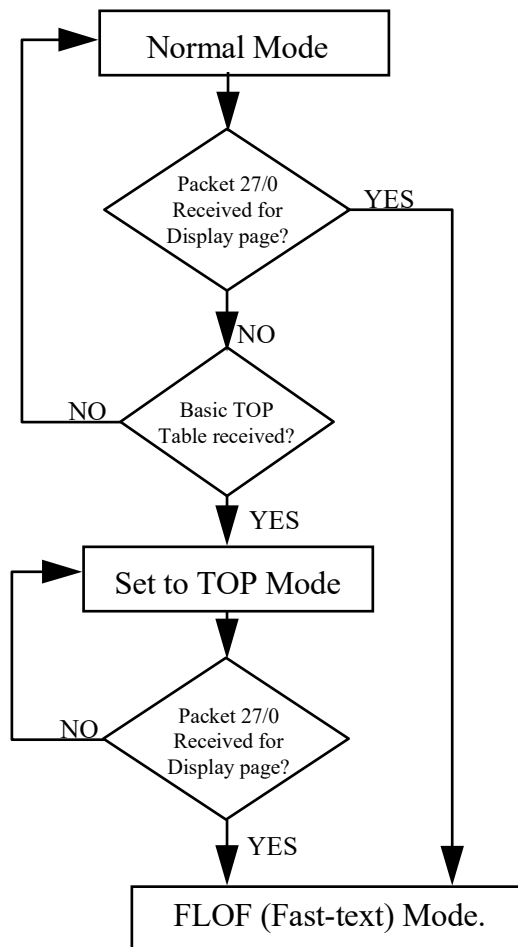
```
                    ┌──────────────────┐
           ┌───────▶│   Normal Mode    │
           │        └──────────────────┘
           │                 │
           │                 ▼
           │            ╱─────────╲
           │           ╱ Packet 27/0╲
           │          ╱  Received for ╲──── YES ────┐
           │          ╲  Display page? ╱            │
           │           ╲─────────────╱              │
           │                 │ NO                    │
           │                 ▼                       │
           │            ╱─────────╲                  │
           │           ╱  Basic TOP ╲                │
           └── NO ─────╲ Table received?╱            │
                        ╲─────────────╱              │
                              │ YES                   │
                              ▼                       │
                    ┌──────────────────┐             │
           ┌───────▶│  Set to TOP Mode │             │
           │        └──────────────────┘             │
           │                 │                        │
           │                 ▼                        │
           │            ╱─────────╲                   │
           │           ╱ Packet 27/0╲                 │
           └── NO ─────╲  Received for ╱              │
                        ╲ Display page? ╱             │
                         ╲─────────────╱              │
                              │ YES                    │
                              ▼                        ▼
                    ┌──────────────────────────────────┐
                    │   FLOF (Fast-text) Mode.          │
                    └──────────────────────────────────┘
```

Store Number	Normal	FLOF	Favourite Page	TOP
0	Display Page	Display Page	Display Page	Display Page
1	Basic TOP Table/Inventory Page	Red	Basic TOP Table/Inventory Page	Basic TOP Table
2	P+1	Green	Favourite Page 1	Add. Information Table
3	P+2	Yellow	Favourite Page 1	Add. Information Table
4	P+3	Cyan	Favourite Page 1	TOP Page 1 (see below)
5	P+4	Index	Favourite Page 1	TOP Page 2 (see below)
6	Last Page	Last Page	Last Page	TOP Page 3 (see below)
7	P-1	P-1	P-1	TOP Page 4 (see below)/Add. Information Table

Table 2: **Pages Stored in Memory.**

The the Four Different Modes of Operation with Sub-page and Menu Page Modes Not Selected

Where 'P' is the page number of the current display page
Where 'Last Page' is the last page number that the user has entered

2.1 Normal Mode

EUROTEXT defaults to Normal Mode on power up and channel change so that this mode is entered for teletext services that do not transmit TOP or FLOF. Row 24 will be generated internally and will display coloured links to the stored pages.

Eurotext has two different displays in normal mode. These modes are software selectable.

The operation of the function keys will reflect the display on row 24.

The coloured keys will have either of the following effects:

RED key	Page - 1
GREEN key	Next Page
YELLOW, CYAN keys	No Effect
INDEX key	Selects Page 100

or:

RED key	Page + 1
GREEN key	Page + 2
YELLOW key	Page + 3
CYAN key	Page + 4
INDEX key	Selects Page 100

When the decoder is first powered up, or after a change channel command, one store is programmed with the page number 1F0.3Fxx(hex). This ensures that if the new channel has a TOP transmission, the basic TOP table is captured in the shortest possible time. The same store is also used to keep an inventory of the transmitted pages. An inventory allows efficient use of the memory, as once complete, capture latches will only be set to pages that are being transmitted. This improves memory efficiency and user friendliness as the users are prompted with a warning message if they attempt to select a non-existent page number. Under these circumstances, the message displayed will be the page number enclosed by '>' and '<' symbols shown in flashing red on the header line.

In normal mode, if a page number is already in store, the decoder will enable the next highest page number which is not in the store, and, if the inventory page is active, the decoder will only search for pages that are being transmitted.

2.2 FLOF Mode

The FLOF mode can either be selected manually or may be selected automatically by EUROTEXT if it is set to AUTO mode. In AUTO mode, the decoder will select FLOF mode if it has received a valid packet 27 for the display page.

When the EUROTEXT decoder selects FLOF mode, all packets 24, 27 and 8/30 will be processed by the internal processor as they are received. The decoder will program the memory with the five links from packet 27 of the display page. Valid links are page numbers 100 to 8FF, links to sub-pages are not processed. This enables the decoder to implement a full FLOF decoder without any external control. Packet 24 is displayed on row 24. The decoder will ensure that the link information is kept live at all times. If a new page is selected that is not in memory, the old link information will remain valid until the new page is received.

The coloured keys will select the pages as defined in packet 27 of the display page.

On selecting FLOF mode, if packet 27 is not received, the decoder will temporarily return to normal mode until a valid packet 27 for the display page is received.

2.3 Favourite Page Mode

In this mode, the external microprocessor has full control over which pages are captured in five of eight page stores. It can enable four favourite pages which will always be stored in memory with another store being used for the display page. The four stores can be programmed with any page number between 100 and 8FF. Sub-pages cannot be programmed as favourite pages but the sub-page mode can be selected which in favourite page mode.

Row 24 is generated internally and will contain the four page numbers displayed in coloured foreground (red, green, yellow, cyan). The page number will be prefixed by the appropriate letter, (e.g. either a 'P' or an 'S' for most Latin languages). If the display page is the same as one of the favourite page numbers, the page number in row 24 will appear in reverse video (i.e. the foreground and background colours will be swapped).

The memory that is not used to store favourite pages will be used to store the last page selected, the display page minus 1 and will also store either the basic TOP table or will generate an inventory of the transmitted pages (see section on Normal Mode for a description of the inventory).

The coloured keys will select the following pages:

RED key	Favourite Page 1
YELLOW key	Favourite Page 2
GREEN key	Favourite Page 3
CYAN key	Favourite Page 4
INDEX key	No action in this mode.

2.4 TOP Mode

The TOP Mode can either be selected manually or may be selected automatically by EUROTEXT if it is set to AUTO mode. In AUTO mode, the decoder will select TOP mode if it has received a valid basic TOP table but has not received a valid packet 27 for the display page.

The EUROTEXT decoder has internal software to implement a TOP decoder without any external microprocessor control. When TOP mode is selected the decoder will capture and store the basic TOP table and up to three additional information tables. The TOP tables will be kept updated automatically. Using the TOP tables, the decoder will automatically generate a row 24 display. The user will be prompted with a warning message if an attempt is made to select a page which is not in the transmission cycle, however, Eurotext will search for the selected page.

The coloured and index keys will have the following functions:

RED key   This key will operate in one of two modes. It will either search backwards in the TOP table and select the next page or the function of this key will depend upon the display page. If a Block Page is displayed, it will select the last Block Page, if a Group Page is displayed it will select the last Group or Block Page and if a Normal Page is selected, it will select the last Block, Group or Normal Page.

GREEN key   Next Block, Group or Normal Page

YELLOW key   This key will operate in one of two modes. It will either search forwards in the TOP table to find the next Block or Group Page, or it will find the next Group Page in the current Block wrapping around in the block boundary.

CYAN key   Next Block Page

INDEX key   TV Block Page/P100. This key will select page 100 unless the display page is page 100 in which case it will select the first TV Block Page.

In all cases, the search for the block page will wrap-around from 899 to 100 and 100 to 899.

In TOP mode the EUROTEXT device uses an intelligent page capture strategy to select which pages are to be stored in the four TOP stores. To give the user the fastest access to teletext pages, the pages enabled for capture will depend upon the last page selected. The stores will always be programmed with different page numbers.

Last Page Selected Via	TOP1	TOP2	TOP3	TOP4 Depends on Current Page
Digit entry, RED Key or TOP initialisation	Next Block, Group or Normal Page	Next Block or Group Page	Next Block Page	If a block page then last block page
Green key or if current page is in the TV block	Next Block, Group or Normal Page	Next Block, Group or Normal Page	Next Block, Group or Normal Page	If group page then last group page
Yellow key	Next Block or Group Page	Next Block or Group Page	Next Block or Group Page	If normal page then last normal page
Cyan Key	Next Block Page	Next Block Page	Next Block Page	

Table 3: Page Selected to be Stored in TOP Mode.

TOP4 Page is Only Stored if There are Less than 3 Additional Information Tables

2.5 Sub-Page Mode

Sub-page mode can be selected in any of the four main modes. In sub-page mode the decoder will capture the display sub-page and the next two sub-pages transmitted for the display page. The row 24 display will show the current page number and the current sub-page number. In addition to the display number, two boxes will be displayed, one red containing a '-' sign and one green containing a '+' sign. The red and green coloured keys will decrement or increment the sub-page number. The original functions of the coloured keys will be suspended during this mode but will resume when sub-page mode is deselected. The original row 24 will be stored in the decoder and will be displayed immediately the sub-page mode is deselected.

Store Number	Normal	FLOF	Favourite Page	TOP
0	Display Page	Display Page	Display Page	Display Page
1	Basic TOP Table or Inventory Page	Red	Basic TOP Table or Inventory Page	Basic TOP Table
2	P+1	Green	Favourite Page 1	Add. Information Table
3	P+2	Yellow	Favourite Page 2	Add. Information Table
4	Next Sub-Page	Next Sub-Page	Next Sub-Page	Next Sub-Page
5	Next Next Sub-Page	Next Next Sub-Page	Next Next Sub-Page	Next Next Sub-Page
6	Last Page	Last Page	Last Page	TOP Page 1 (see below)
7	P-1	P-1	P-1	TOP Page 4 (see below)/Add. Information Table

Table 4: Pages Stored in Memory in the Four Different Modes of Operation

with Sub-Page Mode Selected and Menu Page Mode not Selected

2.6 Menu Page Mode

When the decoder is set to menu mode, it reserves two pages of memory for uses other than receiving teletext. The memory can be used for:

> Menu pages for on-screen displays
> Packet 8/30 format 2 data storage for PDC applications
> Packet 26 storage for PDC applications
> General purpose storage.

When the menu page is set, menus and on-screen displays can be made in either menu page 0 (store 6) or menu page 1 (store 7) by writing the appropriate characters into the teletext memory. When packet 8/30 format 2 storage is selected, each of the four possible interleaves are stored separately in menu page 1.

The controlling microprocessor can read and write bytes to the menu page and can therefore use them for general purpose storage if required.

3.0 CONTROL INTERFACE

The control interface for EUROTEXT has been designed to ensure that only a single byte command is required for all the basic user commands. The commands used have been selected to match the basic commands used by UNITEXT (Texas Instruments' single page decoder) for all the basic teletext commands. The document "TI Common Teletext Interface" describes the software commands which are common between the devices. The EUROTEXT devices will respond to additional commands which are not included in the common interface specification, these commands are contained in the document "Eurotext Software Application Guide'.

4.0 DISPLAY

The display of the chip is 40 characters by 25 rows. The 25th row of data can be either generated on-chip or it can be written to by the external microprocessor. Double size and double width characters are supported by the display processor for received teletext and for menu pages.

The character font ROM holds the required fonts in 10 x 12 pixel format. An RGB output is produced according to the serial control display attributes along with a BLANK (fast blanking) signal which allows the display to be viewed in modes TEXT, MIX or BOX.

5.0 RGB OUTPUTS

The output current of the RGB outputs may be set by adjusting the value of a single resistor connected between RGBSET and AGND. The RGB output stages contain a switch controlled by the internal RGB signal and an adjustable current source. When the internal signal is zero, the switch routes current through the ground terminal of the device and when high, through the appropriate output pin (see circuit diagram on following page).

The output voltage depends on the current generated by the CF70210 and load resistor RL and can be in the range 0.5V to 1.5V with RL=75Ω. This arrangement of current switching has been chosen for two reasons:

1. To avoid high current spikes on the Vcc terminal
2. To minimise the transient behaviour of the current source.

In order to keep the RGB output current between reasonable limits, the CF70210 contains a reference circuit. The reference voltage is typically 1.328V and can be measured on pin REF. If required, an external reference can be connected to pin REF which will overdrive the internal reference.

The reference circuit also generates the control voltage for the adjustable current sources by comparing the currents flowing through resistor $R_{(RGBSET)}$ and the internal reference.

The value of the voltage generated across RL is fixed by:

1. The reference circuit
2. The adjustable current source
3. The resistors $R_{(RGBSET)}$ and RL.

Minimum and maximum output voltages can be calculated using the following equations:

$$R_{(RGBSET)} \quad = \quad \frac{R_L \times V_{REF} \times 60}{V_L}$$

$R_{(RGBSET)}$ R, G, B output current determined by this resistor value

R_L Load resistor on R, G, B outputs

V_{REF} Reference voltage
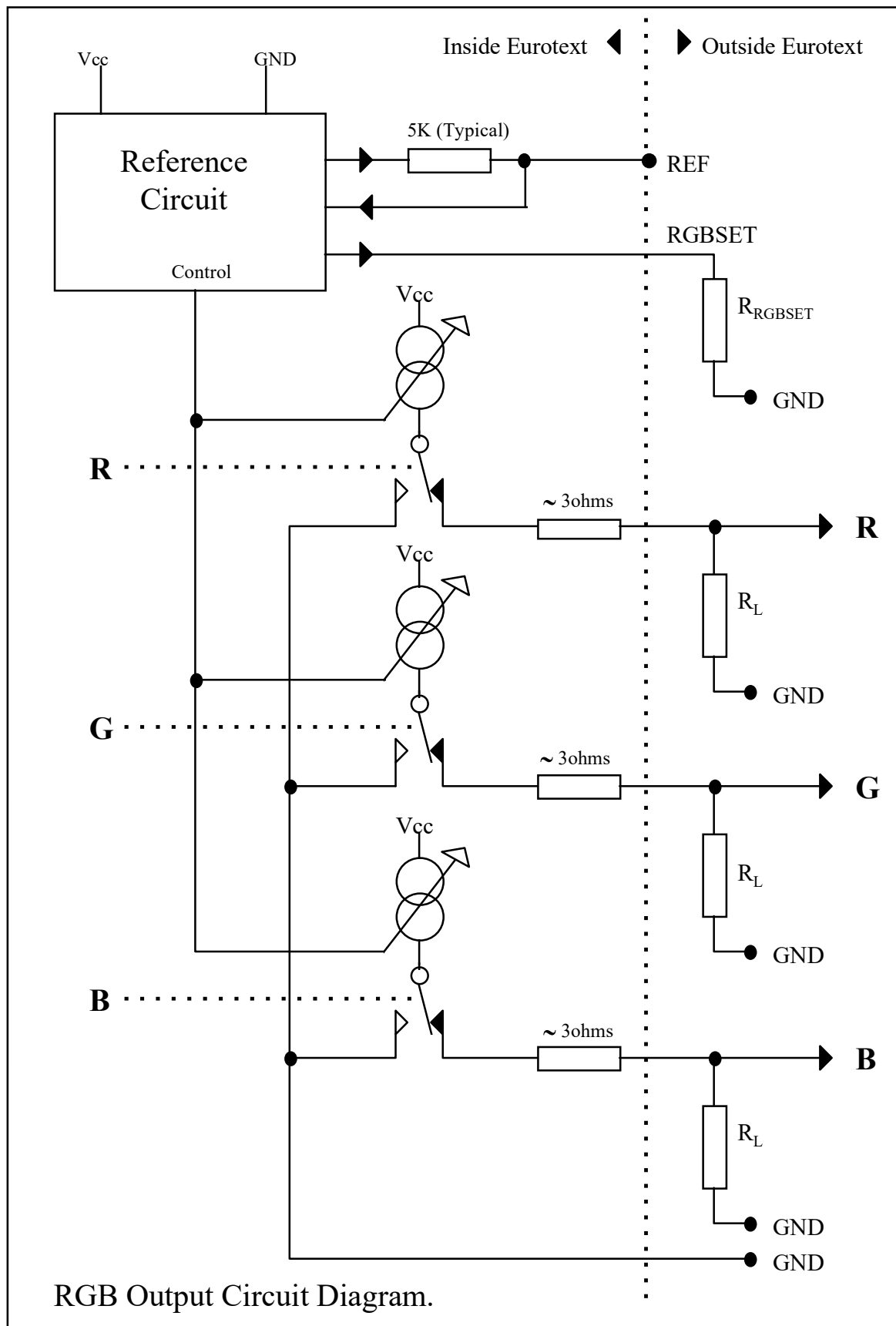
V_L R, G, B output voltage

I_{lmin} $\dfrac{0.75 \times V_{REF}(typ) \times 60}{R_{(RGBSET)} + \Delta R}$

I_{lmax} $\dfrac{1.25 \times V_{REF}(typ) \times 60}{R_{(RGBSET)} - \Delta R}$

$I_{lmin/max}$ R, G, B output current

ΔR Resistor tolerance of $R_{(RGBSET)}$

5.0 RGB OUTPUTS (continued)

RGB Output Circuit Diagram.

6.0 LANGUAGES

The CF70210 device supports only the Hebrew Language.

7.0 SYSTEM TIMING

All system timing functions, including the 11.5625 MHz display pixel clock, are produced in the digital PLL & TV sync timing block using the oscillator output from the Texas Instruments CF72306 or CF72416 data slicer. The display sync signals generated are flexible and can be software controlled to provide interlaced or non-interlaced text displays with locked of unlocked field sync.

The Eurotext chip uses a digital PLL which can lock onto a VCR playback video signal, allowing EUROTEXT to be used for OSD during VCR playback.

8.0 I^{2}C INTERFACE

The EUROTEXT device acts as a slave transceiver and follows I^{2}C-bus protocols.

Data Transfer to EUROTEXT

The sending of command and data bytes to the EUROTEXT is initiated by the bus master which places a start condition on the bus followed by the bus address with the R/W bit set to 0 (hex 22). Command and data bytes are then transferred to the EUROTEXT which acts as a slave receiver. The transfer can consist of any number of bytes and the transfer is terminated when the bus master places a 'start' or 'stop' condition on the bus.

Data Transfer from EUROTEXT

The decoder status, received teletext data, and other data, is transmitted by EUROTEXT when the bus master places a 'start condition' on the bus and sends the bus address with the R/W bit set to 1 (hex 23). The transfer can consist of any number of bytes and the bus master can terminate the transmission by placing a 'start' or 'stop' condition on the bus after not acknowledging the last byte. During the transfer, EUROTEXT will continue to send data as long as the bus master acknowledges each byte and continues to issue clock pulses.

Handshaking

Handshaking is carried out on a byte by byte level as described in the I^{2}C specification. When EUROTEXT is not available for servicing the I^{2}C but requests are made of it, it extends the low period of the SCL clock by holding the SCL line low.

I^{2}C Bus General Call Address

Eurotext does not acknowledge the general call address.

9.0   PIN DESCRIPTION

Data Input Pins

CSB	Composite sync input. This pin should be connected to the SYNC output of the data slicer.
TCLK	Teletext clock signal. This pin should be connected to the TCLK pin of the data slicer.
TDATA	Teletext data. This pin should be connected to the TDATA pin of the data slicer.
WIND	This output is high during the VBI lines of the video signal and is used as a gating signal for the capture of teletext. This pin should be connected to the WIND pin of the data slicer.
VIDEO	Video input to sync switch. The signal to this pin should be AC coupled.

I^2C Interface

SDA	I^2C data line. Open drain I/O pin.
SCL	I^2C clock line. Open drain I/O pin.

Display Pins

BLANK	Blanking. This signal is high when teletext information is displayed on the RGB lines.
R, G, B	Display data (75 ohm drive capacity).
RGBSET	Adjustment for the RGB output levels. The level of the RGB signals can be adjusted from 0.5V to 1.5V by setting the current through this pin using an external resistor.
REF	Internal reference pin. A 10nF capacitor should be connected between this pin and ground.
SYNC	This pin is the output of an internal sync switch. It will either output the composite sync. pulse from the internal sync generator in text mode or it will be connected to the video input pin when any picture information is being displayed.

9.0   PIN DESCRIPTION (continued)
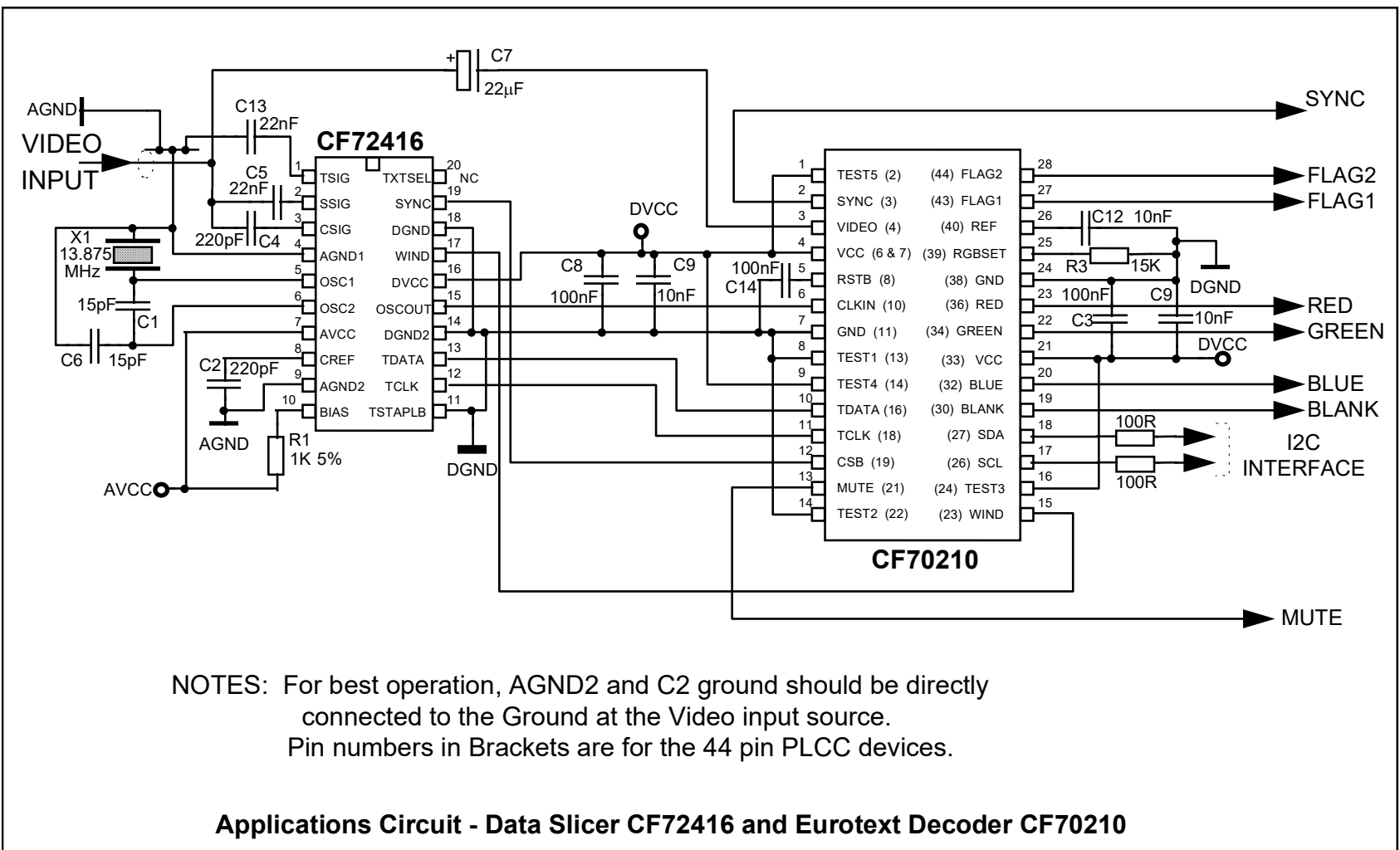
System

CLKIN	System clock 13.875 MHz, driven from the CF72306 or CF72416 data slicer.
RSTB	System Reset active low. The EUROTEXT device has an internal reset circuit. It should be connected to ground via a 100nF capacitor. However, this pin can be used if a hardware system reset is required.
MUTE	Audio Mute control. This signal is low when just text is displayed on the screen and a bad incoming video is detected. It is intended to be connected to the TV audio muting circuit.
FLAG1	System information. Input or output.
FLAG2	System information. Input or output.
TEST1..5	Test pins. These pins should be connected to ground or Vcc as per diagram.
AVCC & DVCC	+5V. The power supplies should be decoupled next to the chip using 100nF and 1nF Capacitors.
AGND & DGND	Ground.

10.0   CF70210   CHARACTER SET

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11.0 Applications Circuits

11.1 Circuit using CF70210 and CF72416

Applications Circuit - Data Slicer CF72416 and Eurotext Decoder CF70210

NOTES: For best operation, AGND2 and C2 ground should be directly
connected to the Ground at the Video input source.
Pin numbers in Brackets are for the 44 pin PLCC devices.

11.2 Circuit using CF70210 and CF72306

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Applications Circuit - Data Slicer CF72306 and Eurotext Decoder CF70210
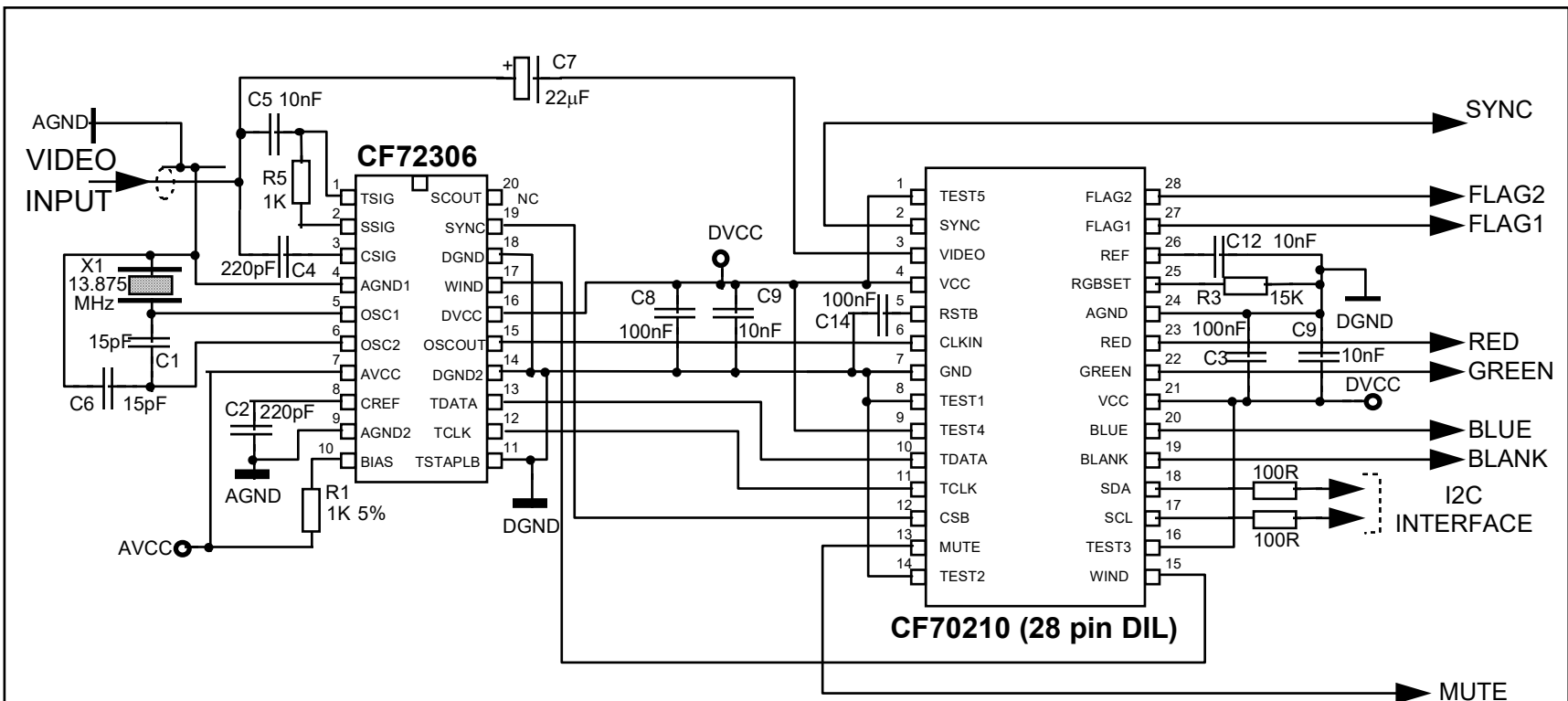
NOTE: For best operation, AGND2 ground should be directly
connected to the Ground at the Video input source.

12.0 ABSOLUTE MAXIMUM RATINGS

Supply Voltage, Vcc	6.5V
Input Voltage	Vcc + 0.5V
Current Any signal pin	±20mA
Operating free air temperature range	0ºC to 70ºC
Storage Temperature range	-65ºC to 150ºC
Latch up	250mA @ 25ºC

Stresses beyond those listed under 'Absolute Maximum Ratings' may cause damage to the device. These are stress ratings only and operation of the device at these or any other condition(s) beyond those indicated in the 'Recommended Operating Conditions' section of this specification is not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

13.0 RECOMMENDED OPERATING CONDITIONS

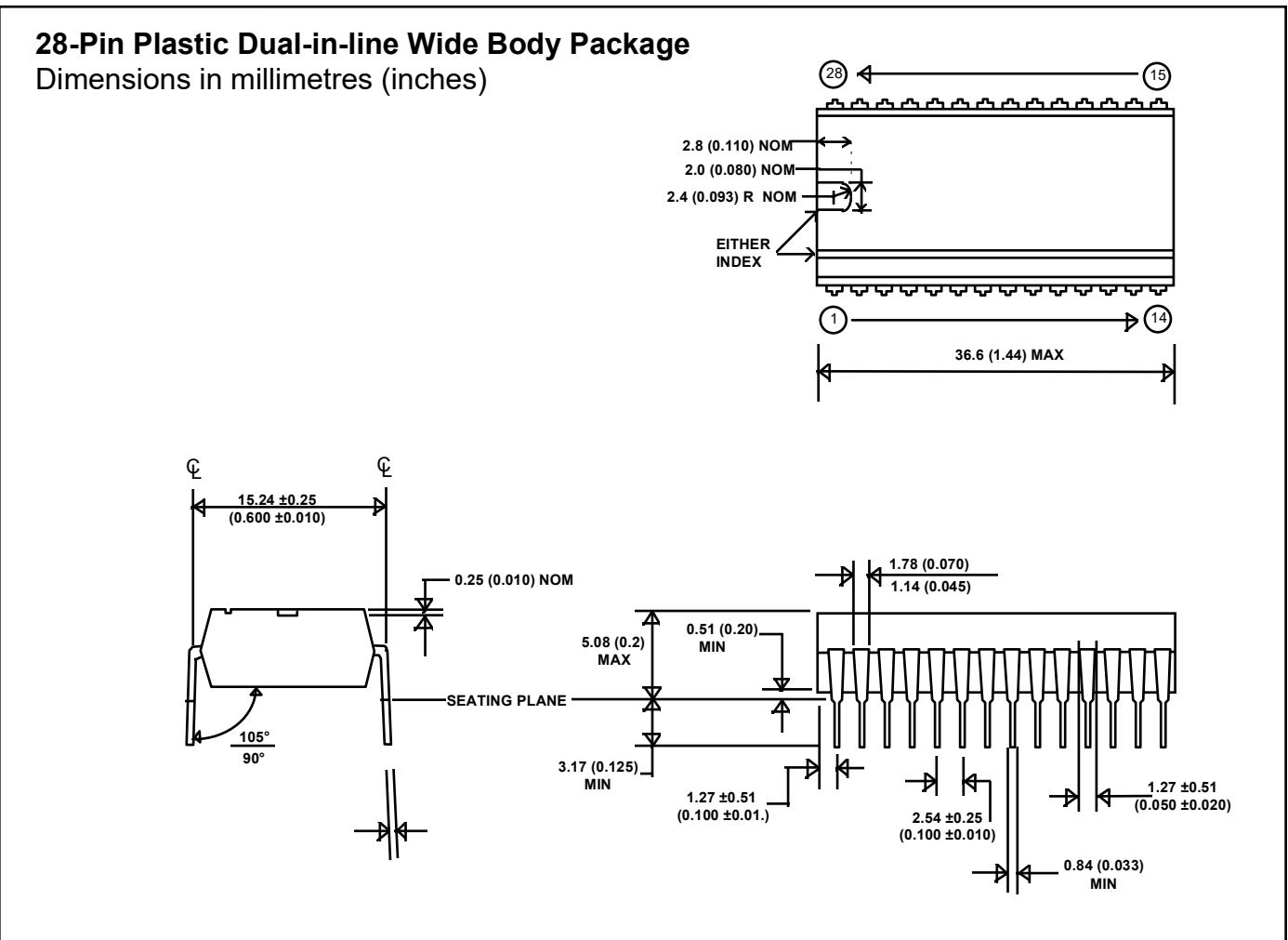| Symbol	Parameter	Test Conditions	min	nom	max	unit
V_{cc}	Supply Voltage	V_{ih} = min, V_{il} = max	4.75	5.00	5.25	V
V_{ih}	High Level Input Voltage	All inputs except SDA & SCL	0.7 Vcc			V
V_{il}	Low Level Input Voltage	All inputs except SDA & SCL			0.2 Vcc	V
V_{ih}	High Level Input Voltage	SDA & SCL	3.0			V
V_{il}	Low Level Input Voltage	SDA & SCL			1.5	V
I_{ih}	Input Current High	Vcc = max TEST1, TEST2 = 0V TEST3, TEST4, TEST5 are not connected			1	µA
I_{il}	Input Current Low	Vcc = max Except $\overline{\text{Reset}}$ TEST1, TEST2 = 0V TEST3, TEST4, TEST5 are not connected			-1	µA
I_{il}	Input Current Low	$\overline{\text{Reset}}$	-1.5		-7.0	µA
V_{oh}	Output Voltage High	Vcc = min All standard outputs I_{oh} 60µA 600µA 6mA	Vcc - 100mV Vcc - 200 mV 3.76			V
V_{ol}	Output Voltage Low	Vcc = min All standard outputs I_{ol} 60µA 600µA			-100 500	mV mV

Table 5: Recommended Operating Conditions

13.0 RECOMMENDED OPERATING CONDITIONS (Continued)

Symbol	Parameter	Test Conditions	min	nom	max	unit
		REF				
V_{ref}	Output Voltage			1.328		V
		RGBSET				
I_{set}	RGB Set Current		-33		-330	μA
		RGB				
I_o	Output Current	R(RGBSET)=40KΩ	1.49		2.48	mA
I_o	Output Current	R(RGBSET)=12KΩ	4.95		8.85	mA
I_o	Output Current	R(RGBSET)=4KΩ	14.9		24.8	mA
R_L	RGB Load	I(RGBSET)<33μA			750	Ω
R_L	RGB Load	110μA<I(RGBSET)<330μA			75	Ω
C_I	Output Load Capacitance			50	750	pF
		Blank (P-Channel Open Drain Output)				
V_{oh}	Output Voltage High	I_{oh} = 23mA	3.7			V
V_{oh}	Output Voltage High	I_{oh} = 2.5mA	4.4			V
I_{oh}	Output Current High				23	mA
C_I	Output Load Capacitance				50	pF
I_{cc}	Supply Current	Vcc = max Active (at f_o)			230	mA
f_o	Operating Frequency			13.875		MHz
R_{on}	Analogue Switch on resistance	V_{cc} = nom VIDEO = 3.7V	10		500	Ω
V_{sync}	Sync	$V_{oh}(I_{SYNC}$= +/-100μA)	2.1		4.1	V
		$V_{oL}(I_{SYNC}$= +/-100μA)	1.6		3.6	V
		Height	0.3		0.7	V

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14.0 PACKAGING

28 pin Plastic Dual in Line (Wide)

28-Pin Plastic Dual-in-line Wide Body Package
Dimensions in millimetres (inches)

2.8 (0.110) NOM
2.0 (0.080) NOM
2.4 (0.093) R NOM

EITHER INDEX

36.6 (1.44) MAX

15.24 ±0.25
(0.600 ±0.010)

0.25 (0.010) NOM

5.08 (0.2) MAX

SEATING PLANE

105°
90°

3.17 (0.125) MIN

1.27 ±0.51
(0.100 ±0.01.)

1.78 (0.070)
1.14 (0.045)

0.51 (0.20) MIN

2.54 ±0.25
(0.100 ±0.010)

0.84 (0.033) MIN

1.27 ±0.51
(0.050 ±0.020)

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FN PLASTIC CHIP CARRIER

(20-terminal package used for illustration)

DIMENSIONS IN MILLIMETRES (INCHES)

17.40 (0.685) min

16.510 (0.650) min

$\frac{1.22 (0.048)}{1.07 (0.0042)}$ x 45°

$\frac{1.35 (0.053)}{1.19 (0.047))}$ x 45°

4.20 (0.165) min

2.29 (0.090) min

$\frac{1.14 (0.045)}{0.64 (0.025)}$ R. Typ.

17.65 (0.695) min

16.662 (0.656) max

6 1 40

7 39

17 29

18 28

0.51 (0.020) R Max
3 Places

14.99 (0.590) min
(at Seating Plane)

1.27 (0.050) T.P.

Seating Plane
(The lead contact points
are within 0.10 (0.004)

$\frac{0.81 (0.032)}{0.66 (0.026)}$ Typ.

1.53 (0.060) Min.

0.64 (0.025) Min.

$\frac{0.53 (0.021)}{0.33 (0.013)}$

44 pin PLCC package

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