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ADVANCED ANALOG

RGB DAC 3400SW

MONOLITHIC CMOS, TRIPLE 4-BIT 60MHz, VIDEO DAC

DESCRIPTION

The RGB DAC 3400SW combines three video speed digital-to-analog converters, internal temperature compensated reference and all the control lines necessary for a full graphics/color monitor interface. All this is contained in a single monolithic low power CMOS/TTL compatible IC.

In a typical application, each of three independent red, green and blue analog outputs will drive a 75 ohm source and load terminated coax that supplies a high resolution video monitor with a palette of 4096 colors.

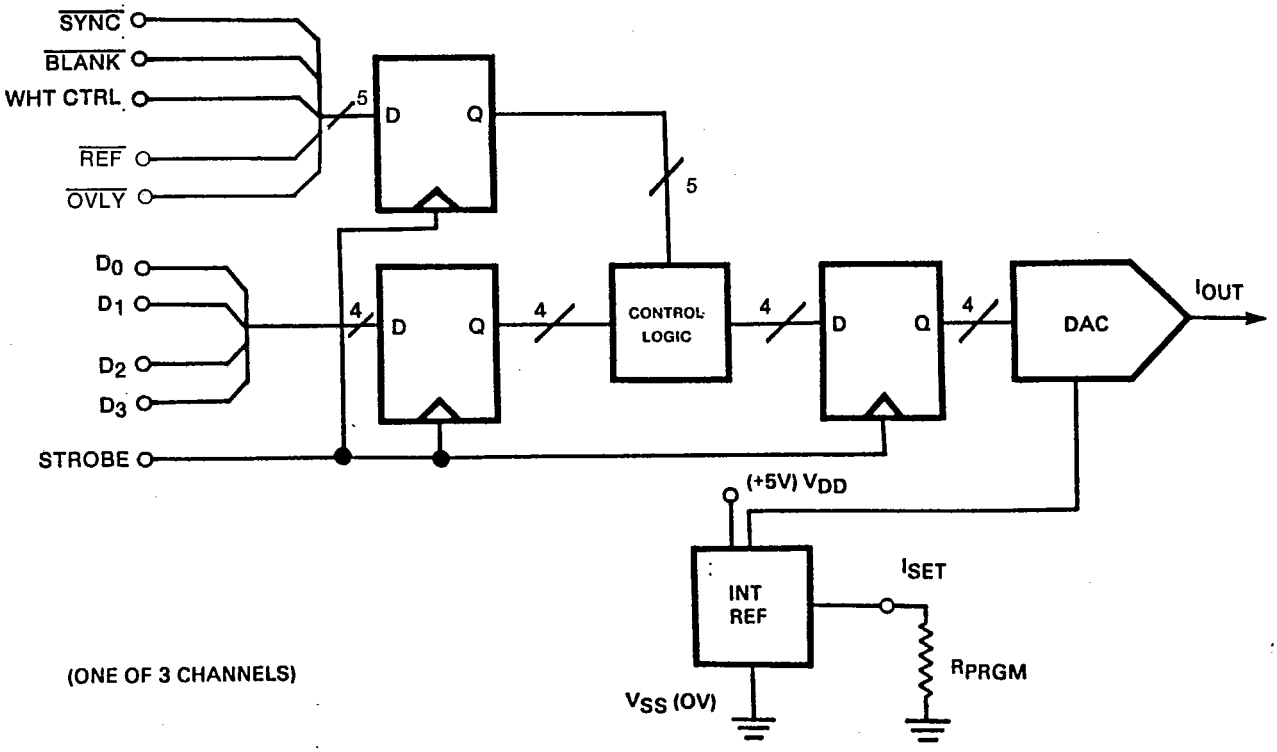
The RGB DAC 3400SW can be directly interfaced to CMOS, HCT, TTL and advanced TTL logic families. It is also capable of developing signals in conformance with EIA standards such as 170/343. Features include small size, synchronous data and control lines for minimal skew and glitch, built-in temperature compensated reference, guaranteed linearity, offset and gain; plus superior temperature coefficients to make the RGB DAC 3400SW a state-of-the-art industry leader.

The RGB DAC 3400SW also includes control logic which implements a text over graphics (overlay) mode.

FEATURES

- State of the art single chip monolithic
- Internal reference, temperature compensated
- Small size - 28-pin DIP
- Single +5V operation
- Fully synchronous operation for minimal skew
- Low power CMOS circuitry
- Ideal interface for videotex systems
- Overlay mode for text over graphics

BLOCK DIAGRAM



SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS		
Supply voltage (V_{DD}-V_{SS})	6	V_{dc} max.
Supply current (75Ω loads)	60	mA max.
Full scale output current	40	mA max.
Drive into any digital input (clamped)	±10	mA max.
Output voltage compliance range (each channel)	-0.3 to +2.5 volts instantaneous	
Logic input voltage range "0"	V_{SS} -0.3	min. V_{dc}
Logic input voltage range "1"	V_{DD} +0.3	max. V_{dc}
Ambient operating temperature range	0 to +70°C	
Ambient storage temperature range	-55 to +125°C	

Recommended Operating Conditions	Min.	Typ.	Max.	Units
Supply voltage (V_{DD}-V_{SS})	4.75	5.00	5.25	V_{dc}
R_L (output load)		37.5		ohms
R_{SET}		2.9K		ohms
Ambient operating temperature range	0	25	70	°C

INPUT CHARACTERISTICS	Min.	Typ.	Max.	Units
Digital		4		bits
Coding		binary		
Compatibility		(TTL or CMOS)		
Loading		One equivalent HCT unit load		
Logic "0" (@ 10μA max.)	0	0.4	0.8	V_{dc}
Logic "1" (@ 10μA max.)	2.0	2.4	5.0	V_{dc}
OUTPUT CHARACTERISTICS				
Offset — All current sources OFF		±1.0	±10.0	μA
Offset — TC		±5.0	±15.0	ppmFS/°C
Gain (Relative to R_{SET})[1]		±5	±10	%
Gain TC		±50	±200	ppm/°C
Gain, variance (each channel, relative to the average of all three)		±2.0	±6.0	%
Linearity				
Integral		±0.1	±0.5	LSB
Differential		±0.1	±0.5	LSB
Linearity TC		±20	±100	ppmFS/°C
Monotonicity		Guaranteed		
Dynamic characteristics				
Max. conversion rate (over operating temperature & supply)	60			MHz
Settling time (to 0.5 LSB)		12		ns
Set-up time	2			ns
Hold time	2			ns
Output transient glitch energy		50		pV-sec
Output transient glitch amplitude		60		mV
GENERAL INFORMATION				
Internal voltage reference	1.26	1.40	1.54	volts
Max. output current drive capability (for combinations of R_{SET} and R_L)	33			mA
Max. ouput voltage drive capability (for combinations of R_{SET} and R_L)	1.5			volts
Power supply current		30	60	mA
Power supply rejection ratio		(-66dB) 0.0005	(-60dB) 0.001	%/%(V_{DD}-V_{SS})

DEVICE OPERATION

The output of the RGB DAC 3400SW is a current source whose full scale value is set by an external resistor. This resistor is connected to an internal reference (1.4V nominal), and the current through the resistor represents 7/16 LSBs of output current. Thus, for a full scale current of 15 LSBs, $I_O = 1.4/R \times 16 \times 15/7 = 48/R$, where I_O = full scale output current, R = current setting resistor (ohms). This resistor is connected from I_{SET} to ground.

Example: $R_L = 37.5\Omega$, $I_O = .0166$ ($V_O = 637.5$ mV from black to white level)

$$R = \frac{48}{I_O} = \frac{48}{0.0166} = 2890(\text{ohm})$$

The value of R would be 5780(ohm) nominal if R_L were 75Ω.

PIN DESCRIPTION

DATA (R_0-R_3, G_0-G_3, B_0-B_3)
These inputs are generally referred to as (D_0-D_3) and are the digital data inputs. They are latched into an edge triggered register on the falling edge of STROBE.

BLANK ($\overline{\text{BLANK}}$)
A logic "0" on this input synchronously sets all three channels to the blank level. This input overrides input data and is used to blank the screen. This input is latched into an edge triggered register on the falling edge of STROBE.

SYNC ($\overline{\text{SYNC}}$)

The sync amplitude (40 IRE units) is synchronously subtracted from the green DAC output when a logic "0" appears at this input. This input is used to generate composite sync and blank signals to the monitor. This input is latched into an edge triggered register on the falling edge of STROBE.

STROBE
This is the main clock input of which the falling edge is used to strobe the data and control inputs into edge triggered registers, as well as move this information in a synchronous pipeline fashion.

ISET (programs gain)

An external resistor connected from this point to V_{SS} programs the DAC full scale outputs in the following manner: I_{out} = 48/R mA, where R is the external resistor value in K ohms.

BIAS

This is the control amplifier output and should be bypassed to V_{DD} with a 0.1 μF capacitor. External loading at this point is not recommended.

RED, GRN, BLU OUTPUT

These are the current outputs for the three channels and are normally resistively connected to V_{SS} with either 75 or 37.5 ohms.

V_{DD}

This is the most positive supply pin and is normally connected to +5V.

V_{SS}

This is the most negative supply pin and is normally connected to ground.

SYNC ADJ

In precision applications, this input may be used to adjust the sync amplitude (nominally 40 IREs) on the green DAC channel. It is normally left unconnected. To adjust this level, connect a 10KΩ potentiometer from V_{DD} to V_{SS} and a 10KΩ resistor from the wiper of the potentiometer to the sync adj pin.

WHITE CONTROL(WHT CTRL)

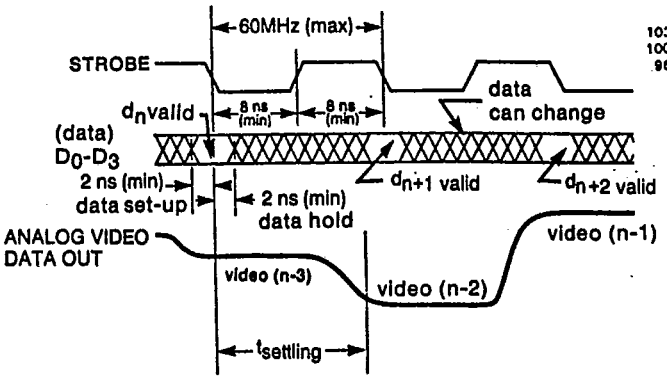
This input synchronously sets the value of the white level output of the three DAC channels. A logic '0' at this input sets the white level of all channels during $\overline{\text{OVLY}}$ and $\overline{\text{REF}}$ to a value equal to the DAC full scale value. A logic '1' at this input sets the white level of all three channels during $\overline{\text{OVLY}}$, and $\overline{\text{REF}}$ to 10% greater than the DAC full scale level. This allows the text overlay to always be brighter than the background intensity.

OVERLAY ($\overline{\text{OVLY}}$)

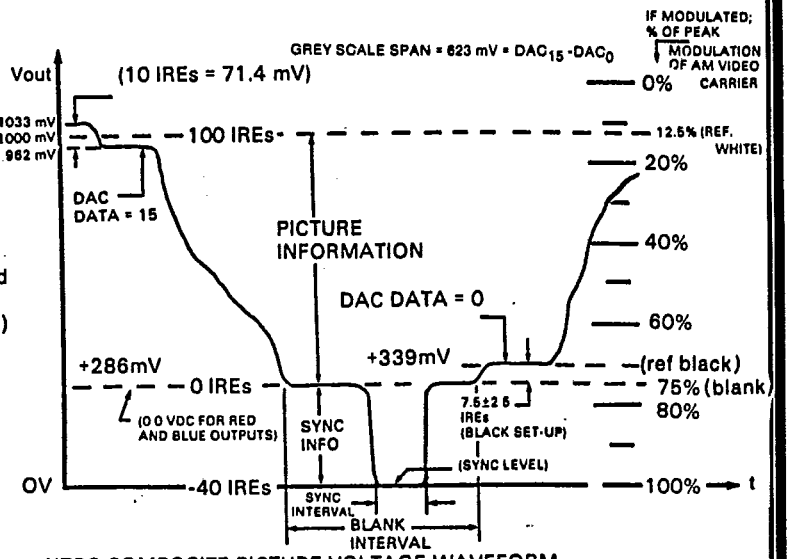
A logic '0' on this line synchronously forces all three DAC outputs to the black level unless the $\overline{\text{REF}}$ line for that channel is active. A logic '1' on this line synchronously disables the REF input for all three channels. This input is latched into an edge triggered register on the falling edge of STROBE.

($\overline{\text{REF RED}}$, $\overline{\text{REF GRN}}$, $\overline{\text{REF BLU}}$)

These inputs are inactive if the $\overline{\text{OVLY}}$ line is held at logic '1'. If the OVLY line is at logic '0' at any of these inputs synchronouly sets the corresponding channel to the REF WHITE level as defined by the WHT CTRL input. The $\overline{\text{OVLY}}$ and $\overline{\text{REF}}$ inputs combine to synchronously override all data and control (Blank and Sync) inputs to the DAC. The $\overline{\text{REF}}$ inputs are normally used to overlay text on the graphics display. These inputs are latched into an edge triggered register on the falling edge of STROBE.



Read Mode Timing Diagram



NTSC COMPOSITE PICTURE VOLTAGE WAVEFORM DEVELOPED FROM RS170 AND CCIR.

Figure 1 *Composite Video Output*

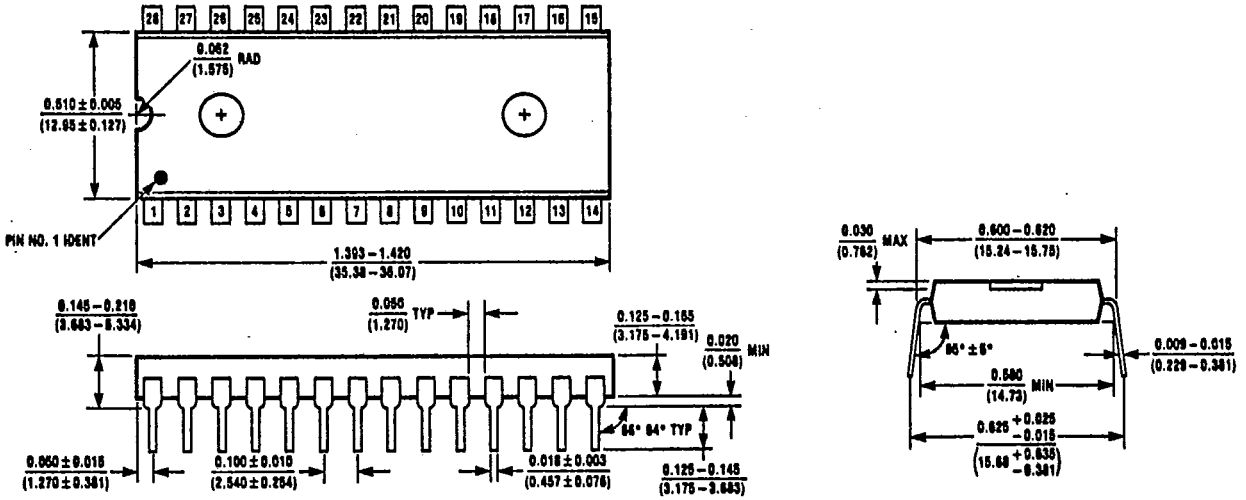
PIN DESIGNATIONS

Pin 1	B_0(LSB)	Pin 28	BIAS
Pin 2	B_1	Pin 27	$\overline{\text{REF BLU}}$
Pin 3	B_2	Pin 26	$\overline{\text{SYNC}}$
Pin 4	B_3(MSB)	Pin 25	$\overline{\text{REF GRN}}$
Pin 5	G_0(LSB)	Pin 24	SYNC ADJ
Pin 6	$\overline{\text{OVLY}}$	Pin 23	GRN OUT
Pin 7	G_1	Pin 22	BLU OUT
Pin 8	G_2	Pin 21	V_{DD}
Pin 9	WHT CTRL	Pin 20	$\overline{\text{STROBE}}$
Pin 10	G_3(MSB)	Pin 19	$\overline{\text{BLANK}}$
Pin 11	R_0(LSB)	Pin 18	$\overline{\text{REF RED}}$
Pin 12	R_1	Pin 17	RED OUT
Pin 13	R_2	Pin 16	V_{SS}
Pin 14	R_3(MSB)	Pin 15	ISET

	$\overline{\text{OVLY}}$	WHT CTRL	REF RGB	SYNC ADJ
RGB DAC 3400SW	yes	yes	yes	yes
RGB DAC 3400S	no	no	no	yes

RGB DAC 3400SW Product Guide

MECHANICAL OUTLINE



 The information in this data sheet has been carefully checked and is believed to be accurate, however, no responsibility is assumed for possible errors. The specifications are subject to change without notice. 2-8701

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