



DAC-8308, DAC-8318

Ultra-Fast 8-Bit Composite Video D/A's

FEATURES

- 40 MHz update rate
- Composite synchronization and blanking
- No deglitching required
- Direct drive to 75 Ω load
- Adjustable setup
- 0°C to +70°C operation

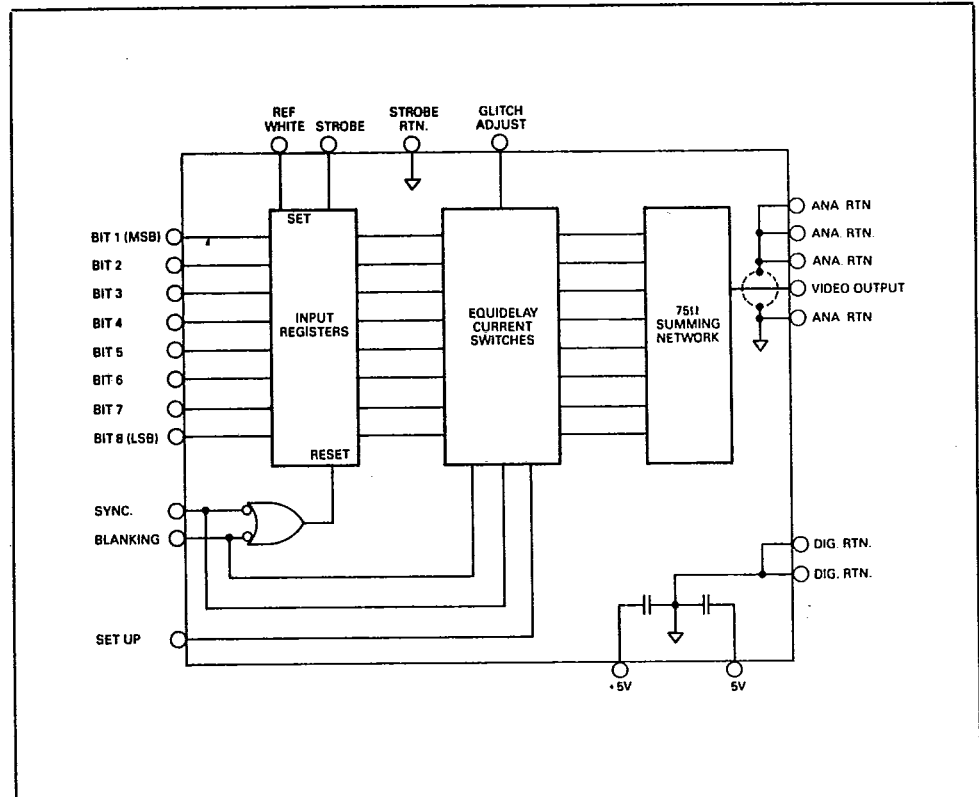
GENERAL DESCRIPTION

DATEL's DAC-8308 and DAC-8318 are high performance, ultra-fast, 8-bit digital-to-analog converters. Functionally complete, including an internal input register, equidelay current switches and a high speed 75 Ω summation network; these devices are specifically designed for video and graphic display applications.

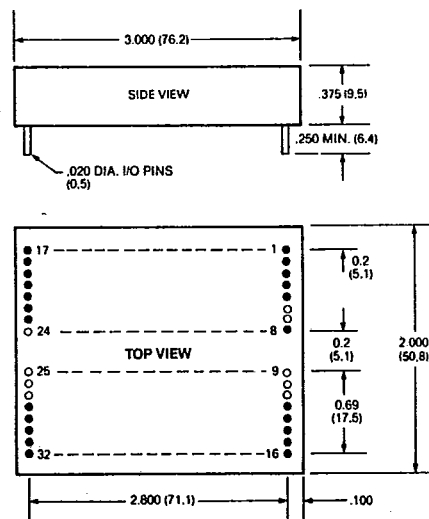
The DAC-8308 accepts 8 bits at throughput rates up to 40 MHz and produces a composite video output signal with 256 gray levels, including setup, blanking and sync., all derived from separate digital inputs. The output will directly drive a terminated 75 ohm coaxial cable giving a 0 to -1.054V output that is in general conformance with EIA standards RS170 and RS343A. Models with a "B" suffix have the output voltage offset by +392 mV so that an input code of 0111 1111 (the middle of the gray scale) produces an output of approximately 0V. Output steps are so clean that deglitching is not required.

The DAC-8318 is the same converter without the composite video digital inputs. An ideal choice for time base correction and function generation applications, the DAC-8318 converts 8 bits of data into a 3 nanosecond rise time output.

Both modules are packaged in 2 x 3 x 0.375 inch cases, allowing 1/2 inch board spacing and operate over the 0°C to +70°C temperature range. Digital inputs are TTL compatible and power requirement is $\pm 5V$. These devices are an excellent choice for applications involving raster scan high resolution video (both color and monochrome), graphic display systems, function generation and time base correction.



MECHANICAL DIMENSIONS INCHES (MM)



- NOTES:
1. OPEN DOTS DESIGNATE OMITTED PINS — ON DAC-8318 PINS 8 + 14 are omitted
2. 0.100 INCH = 2.5mm

INPUT/OUTPUT CONNECTIONS

DAC-8308 DAC-8318

PIN	FUNCTION	FUNCTION
1	ANALOG RETURN	ANALOG RETURN
2	ANALOG RETURN	ANALOG RETURN
3	ANALOG RETURN	ANALOG RETURN
4	VIDEO OUT	OUTPUT
5	ANALOG RETURN	ANALOG RETURN
8	SETUP	
12	STROBE RETURN	STROBE RETURN
13	STROBE	STROBE
14	SYNC.	
15	PEAK WHITE	SET
16	BLANKING	RESET
17	-5V POWER IN	-5V POWER IN
18	DIGITAL RETURN	DIGITAL RETURN
19	DIGITAL RETURN	DIGITAL RETURN
20	+5V POWER IN	+5V POWER IN
21	BIT 1 (MSB) INPUT	BIT 1 (MSB) INPUT
22	BIT 2 INPUT	BIT 2 INPUT
23	BIT 3 INPUT	BIT 3 INPUT
24	BIT 4 INPUT	BIT 4 INPUT
28	GLITCH ADJUST	GLITCH ADJUST
29	BIT 5 INPUT	BIT 5 INPUT
30	BIT 6 INPUT	BIT 6 INPUT
31	BIT 7 INPUT	BIT 7 INPUT
32	BIT 8 (LSB) INPUT	BIT 8 (LSB) INPUT

DAC-8308, DAC-8318**FUNCTIONAL SPECIFICATIONS**

Typical at +25°C, ±5V supplies unless otherwise noted.

OUTPUT CHARACTERISTICS	
Output Voltage Range ¹	0V to -1V ±5% into 75 Ω termination.
Output Current	-28 mA short circuit, -14 mA into 75 Ω.
Recommended Load Impedance	75 Ω ±5%, dc to 10 MHz.
Source (Thevenin) Impedance	75 Ω ±5%, dc to 50 MHz.
Output Bandwidth minimum	100 MHz at -3 dB.
LSB Size; DAC-8308	2.52 mV nominal.
DAC-8318	3.92 mV nominal.
Rise and Fall Time, 10% to 90%	3 nsec. typical, 4 nsec. maximum.
Full Step Settling Time, to 1 LSB	7.5 nsec.
Glitch Settling Time, to 1 LSB ²	5 nsec.
Glitch Area; DAC-8318	Equivalent to 1 LSB step at 50 MHz update rate.
DAC-8308	70 pV-sec. maximum, 50 pV-sec. typical.
TRANSFER CHARACTERISTICS	
Resolution	8 bits, 256 levels.
Coding ³	Binary.
Differential Linearity, maximum	±½ LSB.
Monotonicity	Guaranteed, 10°C to 70°C.
Offset ⁴	±½ LSB maximum, 0°C to 70°C.
Transfer Gain (Slope) Tempco, maximum	±0.02%/°C.
Propagation Delay	10 nsec. typical, strobe to output, 50% points.
INPUT CHARACTERISTICS	
Update Rate	40 MHz.
Input Register ⁵	8 ECL Type D Flip-Flops
Strobe Input	Data entered on positive-going edge (timing reference).
Setup, minimum	7.0 nsec. before strobe.
Hold, minimum	6.0 nsec.
Logic Levels	Standard 7400 TTL Levels.
Data Input Loading (Each of 8 inputs)	Two-unit load.
Strobe Input Loading	Two-unit load.
Control Input Loading, maximum ⁶	2 units each line.
POWER SUPPLY REQUIREMENTS	
Supply Voltage	+5V and -5V, nominal.
Positive Supply: DAC-83XX	5.0V ±5% at 50 mA.
DAC-83XXB	5.0V ±5% at 75 mA.
Negative Supply	-4.75V to -5.5V at 400 mA.
Supply Regulation	Negative supply should not have more than 5 mV peak-to-peak ripple.
Supply Common	Digital Return is the common for the +5V and -5V supplies.
ENVIRONMENTAL AND PACKAGING	
Operating Temp. Range	0°C to +70°C.
Storage Temp.	-25°C to +85°C.
Relative Humidity	0 to 100%, non-condensing.
Mechanical Dimensions	2" x 3" x 0.375" (50 x 75 x 10 mm).
FOOTNOTES:	
1. The output of the DAC-8308 will be 0 to -1.054V.	
2. For worst case (MSB) transition.	
3. DAC-8318: 1111 1111 input code produces 0V output	
0000 0000 input code produces -1V output	
DAC-8308: 1111 1111 input code produces -71 mV	
0000 0000 input code produces -714 mV with standard setup	
—see "Video Characteristics".	
4. DAC-8318—dc output with 1111 1111 input code	
DAC-8308—dc output with peak white input	
5. Includes built-in TTL to ECL translators in data input lines and strobe.	
6. Refers to blanking, sync, and peak white controls for DAC-8318 and set and reset for DAC-8318.	

VIDEO CHARACTERISTICS; DAC-8308 ONLY

Typical at +25°C, ±5V supplies unless otherwise noted.

Composite Video Signal	Consists of 256 gray levels plus Peak or 110% white, blanking level and sync level.
Gray Scale Range	0.643V peak-to-peak.
Step Size	2.52 mV step.
Peak White Level	0V, absolute; +0.768V (110 IRE Units) relative to blanking level with standard Setup; +0.714V relative to Reference Black, +0.071V (10 IRE units) relative to Reference White.
Input Code for White Level	11111111.
Peak White Control	Logic "0" (TTL) on Peak White line overrides video input data and drives the output to 0V.
Reference Black Level	-0.714V absolute; +54 mV (7.5 IRE Units) relative to blanking level with standard Setup.
Input Code for Reference Black Level	00000000.
Composite Blanking Level	-0.768V absolute, with standard Setup.
Input Command for Blanking/Pedestal Level	Logic "0" (TTL) on "Blanking" line simultaneously resets input register to 00000000.
Composite Sync Level	-1.054V absolute with standard Setup; -0.286V (-40 IRE Units) with respect to blanking level (back porch).
Input Command for Sync Level	Logic "0" (TTL) on "Sync" line simultaneously resets input register to 00000000.
Sync and Blanking Rise and Fall Times, maximum	100 nanoseconds.
Sync and Blanking Overshoot, maximum	2%.
Setup (Reference Black-to-Blanking)	Externally programmable from 0 mV (0 IRE Units) to 142 mV (20 IRE Units).
Setup Control Line	Input ground: Standard 54 mV (7.5 IRE Units) Input Open: 71 mV (10 IRE Units) Setup. Input tied to -5V: 142 mV (20 IRE Units). Input tied to +5V: 0 mV (0 IRE Units).

TECHNICAL NOTES

1. The DAC-8308 has three additional current switches in the equi-delay bank: One to inject the Blanking level and one for the Synchronizing level, as required to generate a composite video signal. The Setup Control provides a means for varying brightness in reproducible steps. TV monitors cut off the picture tube in response to the Blanking level, producing the blackest possible visible picture. The Setup control varies the offset between Reference Black level and Blanking level which produces an apparent shift in the "brightness" of Reference Black.

The Blanking and Sync. control lines are asynchronous. The DAC output goes to the command level in about 12 nanoseconds. 12 nanoseconds after removal, the DAC output goes to Reference Black until the next strobe command.

The DAC-8308 has additional user flexibility, achieved by the addition of a Peak White control. Assertion of this input drives the output to its most positive voltage: The whiter than white level, or 110% white to be used for cursors etc.

Peak White sets the input register which turns off the eight gray scale current switches, and the third additional current switch. The Sync or Blanking inputs reset the input register, producing full scale output from the gray scale current



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switches; the output from the Sync. or Blanking current switches is added to the full scale output. Obviously, Peak White should not be activated during the Sync. or Blanking intervals.

- The DAC-8318 full-scale output of 1V peak is fully controlled by the 8-bit data word. The DAC-8318 may be connected to the output of a video A/D to regenerate a TV image on a monitor. Assuming that the input digital data of 8 bits includes the Sync tips.

The Set and Reset inputs of the input register are available on terminals, they produce zero or full scale outputs respectively when activated.

The DAC-8318 is ideally suited for time base correction and function generation applications.

- The DAC-8308 and DAC-8318 series are capable of operation from a negative supply voltage between -4.75V to -5.5V . The output amplitudes specified are nominal values set by internal reference. However, if user adjustment is required, the glitch area will vary slightly as a function of the negative supply voltage. The factory trim is carried out at -5.0V , connect a 10K potentiometer to the Glitch Adjust Terminal. Adjust this pot for minimum glitch area at the major carry transition. This pot may be omitted and the Glitch Adjust Terminal left open.

- EIA Industrial Electronics Tentative Standard No. 1 which will, in the future, become a part of RS170-A, details the exact waveform and timing characteristics of the composite video signal at the output of a color television studio.

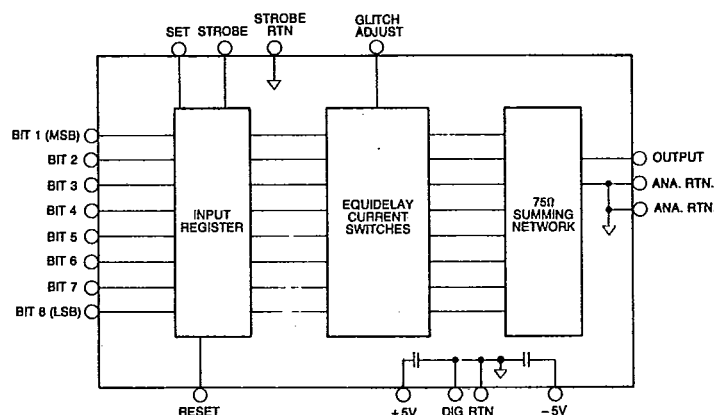
The products described in this data sheet are in general conformance with such needs. Exact compliance requires additional circuitry which would, at a minimum, provide Sin X/X correction and bandwidth filtering.

- The output bandwidth may be reduced, if desired, by adding a small capacitor across the DAC output. This will result in slower rise times. The absolute glitch amplitude will

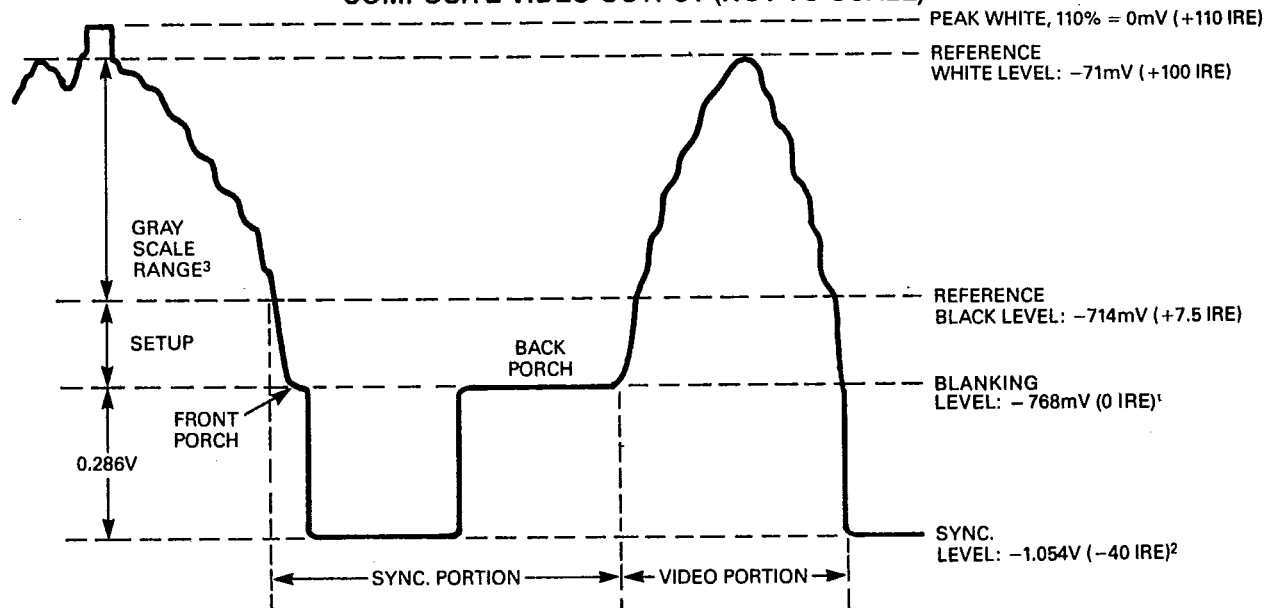
decrease, but the energy (or net area) of the glitch will be unchanged.

- The DIG RTN, ANA RTN and STROBE RTN terminals are all tied together internally. The $+5\text{V}$ and -5V supply common should be connected to DIG RTN. If a long printed circuit wiring connection is required for integration of the DAC into a video system, stripline wiring techniques may be implemented by taking advantage of the physical arrangement of the output terminals i.e., the ANA RTN terminals are located on each side of the VIDEO OUT terminal. ANA RTN normally connects to the shield of an external 75 ohm coaxial cable. STROBE RTN is included as a convenience and may be used optionally to facilitate connection.
- The sync and blanking outputs of the MM5320 TV Timing ROM may not be capable of driving the DAC-8308 series, under worst case conditions, without the use of a logic driver.
- All timing is referenced to the positive edge of the strobe. Setup and Hold require 7.0 nanoseconds and 6.0 nanoseconds, respectively.

DAC-8318 BLOCK DIAGRAM

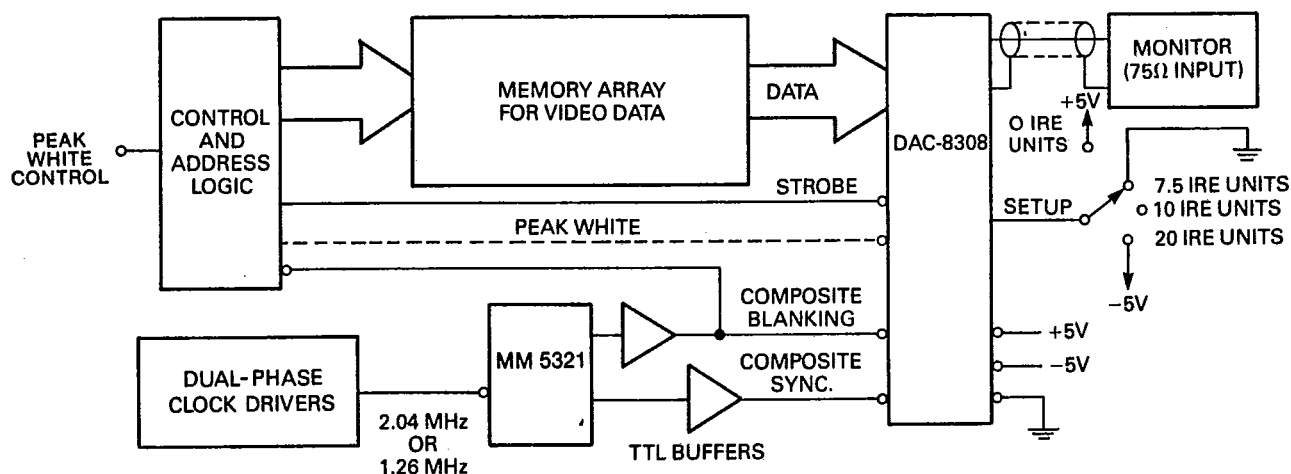


COMPOSITE VIDEO OUTPUT (NOT TO SCALE)



- For Standard -7.5 IRE Setup. For -10 IRE Setup = -785 mV , -20 IRE = -857 mV .
- For Standard -7.5 IRE Setup with Blanking present during Sync time.
For -10 IRE Setup = 1.071V , -20 IRE = -1.143V .
0 IRE Setup or with Blanking not present during Sync = -1.000V
- Gray Scale: $\text{LSB} = 2.52\text{ mV} = 0.363\text{ IRE}$
 $\text{MSB} = 321\text{ mV} = 46.43\text{ IRE}$

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TYPICAL SMALL DISPLAY SYSTEM

With this circuit, digital video data, digital sync. and digital blanking are converted directly to a composite monitor input. Analog mixing and/or generation of the sync/blanking is not required, nor is a separate high power driver amplifier required ahead of the monitor. With the inherently low glitch design of the DAC-8308/8318, a deglitcher is not required and video data need not be "aligned" to achieve low glitch performance.

GLOSSARY OF VIDEO TERMS

COMPOSITE VIDEO SIGNAL

COMBINED VIDEO SIGNAL
The combined video signal, with or without Setup, plus the Sync signal.

VIDEO SIGNAL

VIDEO SIGNAL
The visually perceived portion of the composite video signal which varies in gray scale levels from Reference White to Reference Black. Also known as the picture signal.

SYNC OR COMPOSITE SYNC SIGNAL

That portion of the composite video signal which synchronizes the scanning process.

SYNC LEVEL

Sync Level
The level of the peak of the Sync signal.

SETUP

The difference in level between the Reference Black level and the Blanking level. Not to be confused with setup as used in conjunction with digital logic.

RASTER-SCAN

The basic method of sweeping across a CRT, a line at a time, to generate and display pictures such as used in commercial TV in the USA.

MONOCHROME VIDEO

Conventional black-and-white television video in which the Z-axis, or intensity, of the beam is modified during scanning to shade and/or outline images.

BLANKING LEVEL

The level which separates the Sync portion from the video signal, with or without Setup. This level is sometimes also called the pedestal, back porch or front porch. It usually refers to the level which will cut off the TV tube, producing the blackest possible visual picture.

REFERENCE BLACK LEVEL

Maximum Negative Polarity Amplitude
The maximum negative polarity amplitude of the video signal.

REFERENCE WHITE LEVEL

MAXIMUM POSITIVE POLARITY AMPLITUDE
The maximum positive polarity amplitude of the video signal.

PEAK WHITE LEVEL

A “Whiter than White” Level not within the range of the normal picture. Sometimes used for generating cursors or outlines because it contrasts with all gray shades including white.

GRAY SCALE

Discrete Levels
The discrete levels for the video signal between Reference White and Reference Black levels.

COLOR VIDEO (RGB)

As used herein, this refers to the method of generating color images by combining the three primary colors of red-green-blue (RGB). The associated monitor would be identified as an "RGB" monitor. Three DAC-8308 series D/A converters are required to drive such a monitor, one each for red, green and blue.

ORDERING INFORMATION

MODEL NO.	OUTPUT
DAC-8308	Unipolar
DAC-8308B	Bipolar
DAC-8318	Unipolar
DAC-8318B	Bipolar