FEATURES

- **Composite Video Output**
- **8-Bit resolution**
- **8 Nanoseconds maximum settling time**
- **Single supply operation**
- **Industry-standard pin-out**

GENERAL DESCRIPTION

DATEL's DAC-0805 is a high performance, ultra-fast, hybrid digital-to-analog converter specifically designed for video and graphic display applications. This converter has the self-contained digital sync, blanking, 10% bright, and reference white control inputs required for compatibility with EIA standards RS-170 and RS-343A.

The DAC-0805 provides 8 bits of resolution, or 256 levels of gray scale, and settles in a maximum of only 8 nanoseconds.

The DAC-0805 uses high speed ECL input registers and current switches to minimize time skew and glitch amplitude. Glitch energy, typically 50 pV-S, may be optimized for individual system performance with the glitch adjust input.

Other important features include an output impedance of 75Ω, full-scale output current of −17 mA, ±½ LSB linearity and guaranteed monotonic performance.

Model DAC-0805 is cased in a 24-pin ceramic package and operates over the industrial, −25°C to +85°C temperature range. Power requirement is −5.2V. The ultra-high speed, low cost, small size and circuit completeness of these converters make them an excellent choice for applications including high resolution raster scan graphics displays (both color and monochrome) TV video reconstruction, and function generation.
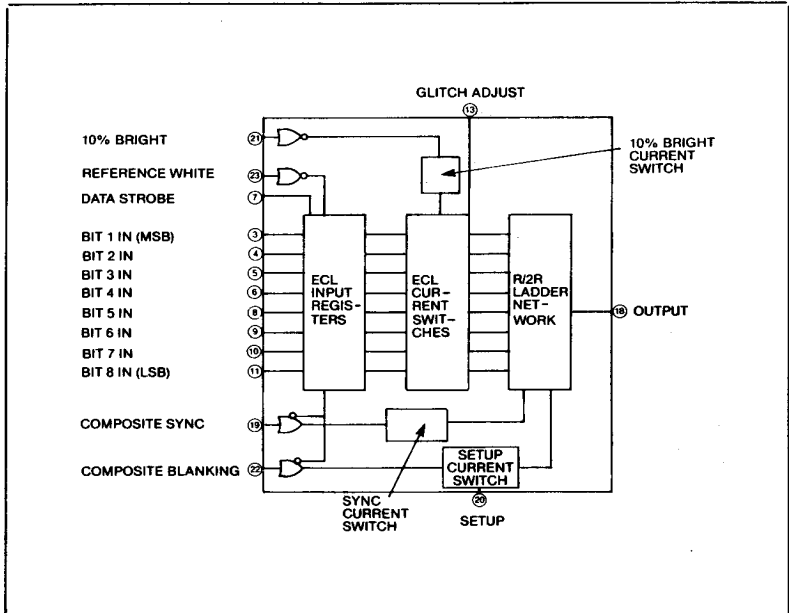
MECHANICAL DIMENSIONS INCHES (MM)

NOTE: PINS HAVE 0.025 INCH STANDOFF FROM CASE, ±0.01"
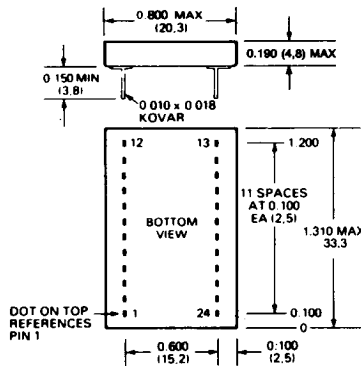
INPUT/OUTPUT CONNECTIONS

PIN FUNCTION	PIN FUNCTION
1 Ground	13 Glitch Adjust
2 −5.2V Supply	14 Ground
3 Bit 1 (MSB)	15 Ground
4 Bit 2	16 Ground
5 Bit 3	17 Ground
6 Bit 4	18 Analog Output
7 Data Strobe	19 Composite Sync
8 Bit 5	20 Setup
9 Bit 6	21 10% Bright
10 Bit 7	22 Composite Blanking
11 Bit 8 (LSB)	23 Reference White
12 Ground	24 −5.2V Supply

FUNCTIONAL SPECIFICATIONS
Typical at +25°C, −5.2V dc supply, unless otherwise noted.

DIGITAL INPUTS	DAC-0805
Resolution	8 bits
LSB Weight, Voltage	2.5 mV
Current	6.7 μA
Coding	Complementary Binary
Logic Compatibility	ECL
Input Logic Level, Bit ON, "0"	−1.7V
Input Logic Level, Bit OFF, "1"	−0.9V
Logic Loading[1]	5 pF and 50 kΩ to −5.2V
Data Strobe Input: Set Up Time, min.	2.5 nsec.
Hold Time, min.	1.5 nsec.
Propagation Delay	3 nsec.
Logic Loading	50 pF and 5 kΩ to −5.2V

SETUP CONTROL[2] (Pin 20)	
Setup Grounded	0 mV (0 IRE Units)
Setup Open	71 mV (10 IRE Units)
Setup at −5.2V	142 mV (20 IRE Units)

OUTPUTS	
Output Current	0 to −17 mA
Output Voltage, 75Ω Load[3]	0 to −600 mV 0 to −630 mV 0 to −637.5 mV
Compliance Voltage	±1.1V
Output, 10% Bright (Pin 21) = Logic "0"	
Current	−1.9 mA ±5%
Voltage	−71 mV ±5%
Output, Composite Sync (Pin 19) = Logic "0"	
Current	−7.6 mA ±5%
Voltage	−286 mV ±5%
Output, Composite Blanking (Pin 22) = Logic "0"	
Current[4] (±1%)	−17 mA, −18.9 mA or −20.8 mA
Voltage[4] (±1%)	−637.5 mV, −708.75 mV or −780 mV

PERFORMANCE	
Absolute Accuracy[5]	±½ LSB
Integral Linearity Error	±½ LSB
Integral Linearity Tempco	16 ppm of FSR/°C
Monotonicity	Guaranteed
Zero Offset Error	0.9 mV
Zero Offset Tempco	6 ppm of FSR/°C
Gain Tempco	17 ppm/°C
Voltage Output Settling Time, max.	8 nsec. to 0.4% GS
Output Slew Rate	200 V/μsec.
Output Rise Time	3 nsec.
Update Rate[6]	100 MHz
Glitch Energy[7]	50 pV − S
Digital Input Settling Time[8]	8 nsec.

POWER REQUIREMENTS	
Power Supply Voltage	−5.2V
Power Supply Range	−4.75V to −5.45V
Quiescent Current	320 mA

PHYSICAL/ENVIRONMENTAL	
Operating Temperature Range	−25°C to +85°C
Storage Temperature Range	−55°C to +125°C
Package Type	24-Pin Ceramic DIP
Pins	0.010 x 0.018 inch Kovar

FOOTNOTES:
1. Except Data Strobe input (Pin 7).
2. Setup refers to the difference between the reference black level and the blanking level.
3. The difference between the full-scale output of 637.5 mV and 643 mV shown elsewhere in this data sheet is because an LSB value of 2.5 mV was chosen for ease of calibration. This difference is well within the tolerance allowed by RS-170.
4. The three currents and voltages correspond to setup levels of 0, 10 and 20 IRE units.
5. Absolute accuracy error is relative to gray scale and includes linearity.
6. These converters may be updated to a maximum of 125 MHz with some degradation of settling time.
7. Reducible to less than 25 pV − S with glitch adjustment.
8. Settling time to 10% of final value. Specified for sync, blanking, reference white, reference black and 10% bright inputs.

TECHNICAL NOTES

1. The use of a good ground plane around the device must be used. A double sided copper board with ground plane on one side and conductors on the other side is recommended. All ground pins should be soldered to the ground plane as close as possible to where they leave the package.

2. Standard 24-pin sockets are not recommended for use with the DAC-0805 series. If sockets must be used, use only spring-loaded pin sockets for each pin. Insert through plated holes on the printed circuit board and solder them to pads on the conductor side.

3. The power supply should be bypassed with a 1 μF or larger tantalum capacitor and a 0.1 μF high frequency ceramic capacitor as close as possible to the power pin (within ½ inch).

4. A well regulated and ripple free, −5.2V power supply must be used for maximum accuracy. The output of these devices will change 1 mV for every 1 mV of power supply change. Therefore, it is important that the supply ripple be less than ½ LSB or less than 1 mV for the DAC-0805. The use of a stable power supply will also enhance the accuracy of the devices over the effects of time and temperature.

5. The minimum set-up time for these D/A's is specified at 2.5 nanoseconds; this is the time the data must remain on the inputs before the strobe is applied. A minimum strobe hold time of 1.5 nanoseconds must be allowed to ensure that the data is latched.

6. The DAC-0805 has extremely low glitch energy levels and normally needs no adjustment. However, if glitch adjustment is required, an external 200Ω trimpot should be connected to the GLITCH ADJUST (pin 13) as close to the pin as possible, and adjusted for equal positive and negative peak glitch signal levels. (See typical connections.)

GLOSSARY OF VIDEO TERMS

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

GLOSSARY OF VIDEO TERMS (Con't)

SYNC OR COMPOSITE SYNC SIGNAL
That portion of the composite video signal which synchronizes the scanning process.

SYNC LEVEL
The peak level of the composite Sync signal.

SETUP
The difference 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 as commonly 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 CRT, producing the blackest possible picture.

REFERENCE BLACK LEVEL
The maximum negative polarity amplitude of the video signal.

REFERENCE WHITE LEVEL
The maximum positive polarity amplitude of the video signal.

10% BRIGHT 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
The discrete levels of 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-0805 series D/A converters are required to drive such a monitor, one each for red, green and blue.

CONNECTIONS AND PERFORMANCE

TYPICAL CONNECTIONS
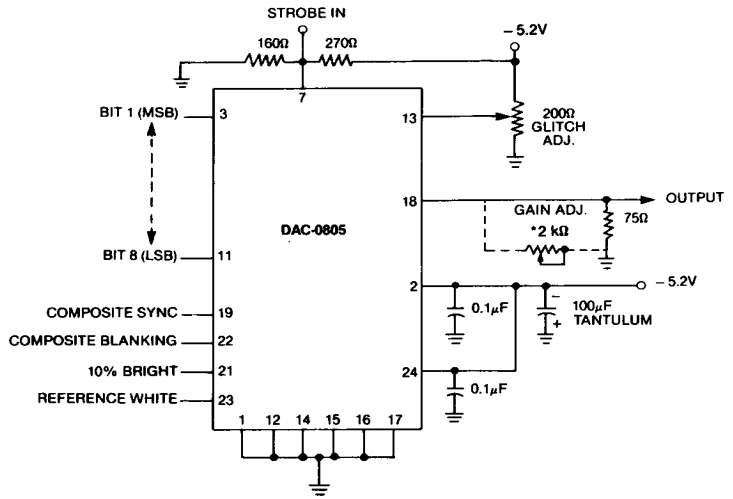
*OPTIONAL

NOTE: All digital inputs terminated to −5.2V through 2 kΩ except strobe.

COMPOSITE VIDEO OUTPUT SIGNAL

APPLICATION

TYPICAL RASTER SCAN DISPLAY SYSTEM
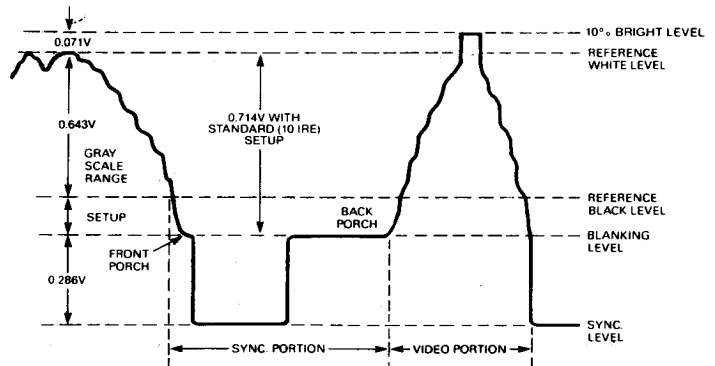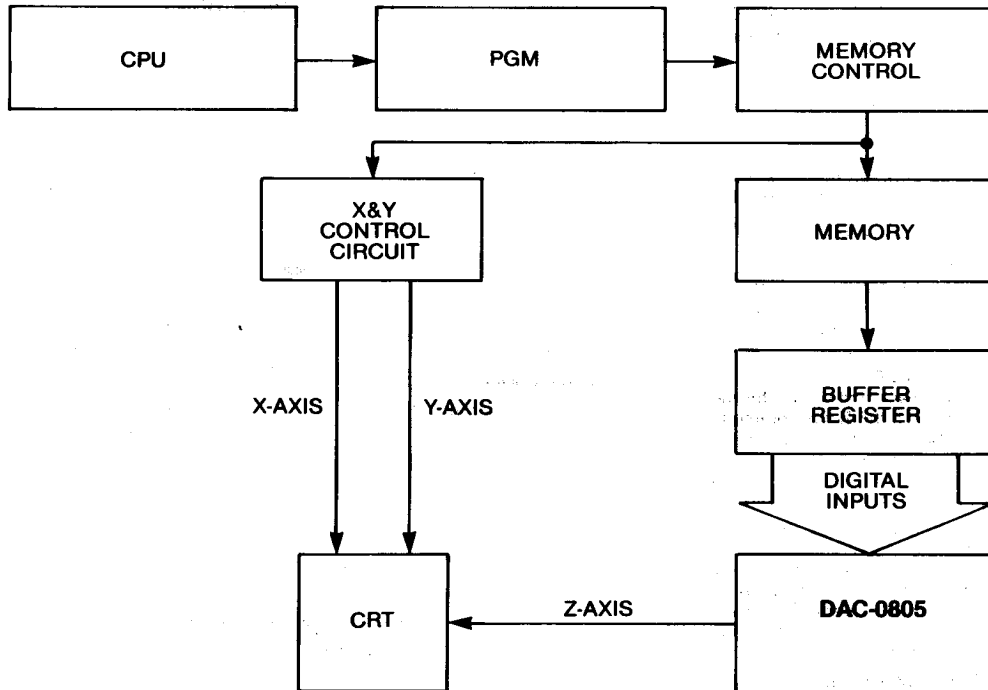
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┌──────────────┐      ┌──────────────┐      ┌──────────────┐
│     CPU      │ ───> │     PGM      │ ───> │   MEMORY     │
│              │      │              │      │   CONTROL    │
└──────────────┘      └──────────────┘      └──────────────┘
                             │                      │
                             ▼                      ▼
                      ┌──────────────┐       ┌──────────────┐
                      │     X&Y      │       │   MEMORY     │
                      │   CONTROL    │       │              │
                      │   CIRCUIT    │       └──────────────┘
                      └──────────────┘              │
                                                    ▼
              X-AXIS        Y-AXIS          ┌──────────────┐
                                            │   BUFFER     │
                                            │  REGISTER    │
                                            └──────────────┘
                                                DIGITAL
                                                INPUTS
              ┌──────────────┐    Z-AXIS    ┌──────────────┐
              │     CRT      │ <─────────── │  DAC-0805    │
              └──────────────┘              └──────────────┘
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The DAC-0805 is particularly useful in raster scan display systems. The above system functions as an intelligent peripheral to the host CPU, and drives a standard television monitor.

The system consists of a MOS RAM memory buffer for storing display data, a memory controller for updating the CRT display, and a programmable microprocessor for graphics generation and image manipulation.

DIGITAL CONTROL INPUTS

STROBE-(Pin 7)
Logic "0" to Logic "1" transition transfers digital input data to the register.

SETUP-(Pin 20)
Three user programmable levels:

INPUT	BLANKING LEVEL (from Reference Black)	IRE Units
1. Grounded	0 mV	0
2. Open	−71 mV	10
3. −5.2V	−142 mV	20

10% BRIGHT-(Pin 21)
Logic "0" causes output to go positive by 71 mV. The most positive voltage remains 0V absolute. All other levels are shifted down by 71 mV.

REFERENCE WHITE-(Pin 23)
Logic "0" set the D/A's output to Full-Scale (Reference White Level). This is 0V absolute or 714 mV more positive than the Blanking Level (643 mV more positive than the Reference Black Level) with Standard Setup.
NOTE: This pin should be held at a logic "1" when the Composite Blanking input is activated.

COMPOSITE SYNC-(Pin 19)
Logic "0" resets the input register to all "0's" and the output voltage goes negative by 286 mV with respect to the Composite Blanking Level.

COMPOSITE BLANKING-(Pin 22)
Logic "0" resets the input register to all "0's" and sets the output voltage negative by the amount of setup voltage with respect to the Reference Black Level.

ORDERING INFORMATION

MODEL	RESOLUTION	SETTLING TIME
DAC-0805MR	8 Bits	8 nsec.

For military devices compliant to MIL-STD-883, consult the factory.