

TRIPLE 8-BIT D/A CONVERTER

- 3 CHANNEL D/A CONVERTER
- 8-BIT RESOLUTION
- 70 MEGASAMPLES PER SECOND CONVERSION RATE
- AUXILIARY ANALOG R, G, B, SWITCHING CAPABILITIES
- SINGLE VOLTAGE +5V OPERATION
- ON-CHIP VOLTAGE REFERENCE
- VOLTAGE OUTPUT BUFFER AMPLIFIER
- TTL COMPATIBLE DIGITAL INPUTS
- BINARY INPUT ON ALL CHANNELS
- 2's COMPLEMENT INPUT CAPABILITY ON TWO CHANNELS
- MONOLITHIC BIPOLAR
- 850mW POWER DISSIPATION
- OPERATING TEMPERATURE RANGE 0°C TO +70°C

The STV8438CV contains three 8-bit D/A converters with a high performance on-chip voltage reference.

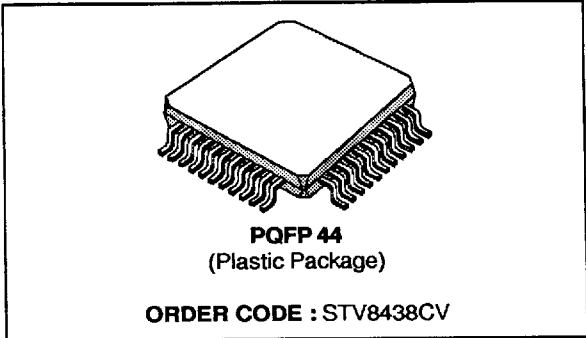
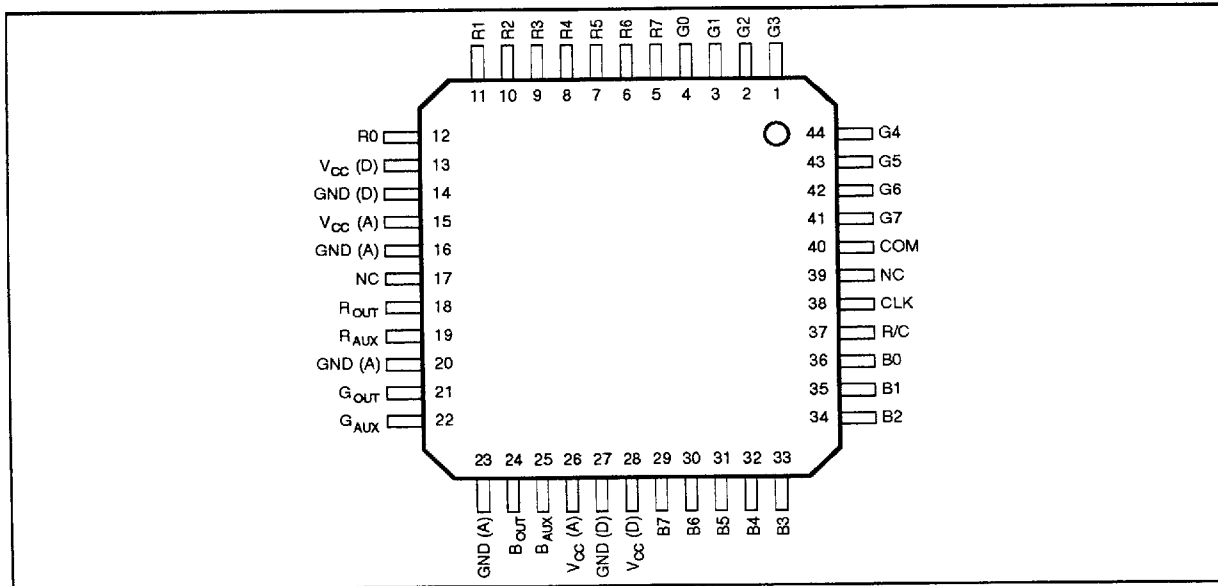
Internal analog multiplexing between the signals from the internal D/A converter and from auxiliary analog R, G, B signals is provided. Either binary or 2's complement inputs are available for two of the three channels.

This device is particularly recommended for use in video processing applications with the capability of 70MSPS data conversion rate with excellent linearity.

DESCRIPTION

This Digital-to-Analog converter is a monolithic voltage output converter which can accept TTL-level digital input voltages.

PIN CONNECTIONS



PIN LIST

Pin Number	Symbol	Type	Function
41 to 44, 1 to 4	G<0:7>	I	Digital Input Channel G
5 to 12	R<0:7>	I	Digital Input Channel R
13, 28	V _{CC} (D)	I	Digital Power Supply
14, 27	GND (D)	I	Digital Ground
15, 26	V _{CC} (A)	I	Analog Power Supply
16	GND (A)	I	Analog R Channel Ground
18	R _{OUT}	O	Analog Output, R Channel
19	R _{AUX}	I	Auxiliary Analog Input, R Channel
20	GND (A)	I	Analog G Channel Ground
21	G _{OUT}	O	Analog Output, G Channel
22	G _{AUX}	I	Auxiliary Analog Input, G Channel
23	GND (A)	I	Analog B Channel Ground
24	B _{OUT}	O	Analog Output, B Channel
25	B _{AUX}	I	Auxiliary Analog Input, B Channel
29 to 36	B<0:7>	I	Digital Input Channel B
37	R/C	I	Binary or 2's Complement Selection
38	CLK	I	Clock Input
40	COM	I	Analog Switch Selection

8438C-01.TEL

PIN DESCRIPTION

G<0:7> : Digital input channel G

These TTL 8-Bit input data are sampled on the rising edge of the clock CLK. G₀ is the LSB and G₇ the MSB, coding is binary.

R<0:7> : Digital input channel R

These TTL 8-Bit input data are sampled on the rising edge of the clock CLK. R₀ is the LSB and R₇ the MSB. Coding is binary if the R/C input is high, coding is 2's complement if the R/C input is low.

B<0:7> : Digital input channel B

These TTL 8-Bit input data are sampled on the rising edge of the clock CLK. B₀ is the LSB and B₇ the MSB. Coding is binary if the R/C input is high, coding is 2's complement if the R/C input is low.

R/C : Binary/2's complement coding selection

This TTL input selects the coding type on R and B channels.

R/C = 0 selects 2's complement coding on R and B channels.

R/C = 1 selects Binary coding on R and B channels.

R_{AUX} : Auxiliary analog input, R channel

This analog input is connected to the output R_{OUT} through the output amplifier if the COM signal is low.

G_{AUX} : Auxiliary analog input, G channel

This analog input is connected to the output G_{OUT} through the output amplifier if the COM signal is low.

B_{AUX} : Auxiliary analog input, B channel

This analog input is connected to the output B_{OUT}

through the output amplifier if the COM signal is low.

R_{OUT} : Analog output, R channel

This voltage analog output corresponds to the digital channel R if the COM signal is high or to the auxiliary analog input R_{AUX} if the COM signal is low.

G_{OUT} : Analog output, G channel

This voltage analog output corresponds to the digital channel G if the COM signal is high or to the auxiliary analog input G_{AUX} if the COM signal is low.

B_{OUT} : Analog output, B channel

This voltage analog output corresponds to the digital channel B if the COM signal is high or to the auxiliary analog input B_{AUX} if the COM signal is low.

CLK : Clock signal

The digital inputs are sampled on the rising edge of this TTL input signal.

V_{CC} (A) / GND (A) : Analog power supply.

V_{CC} (D) / GND (D) : Digital power supply.

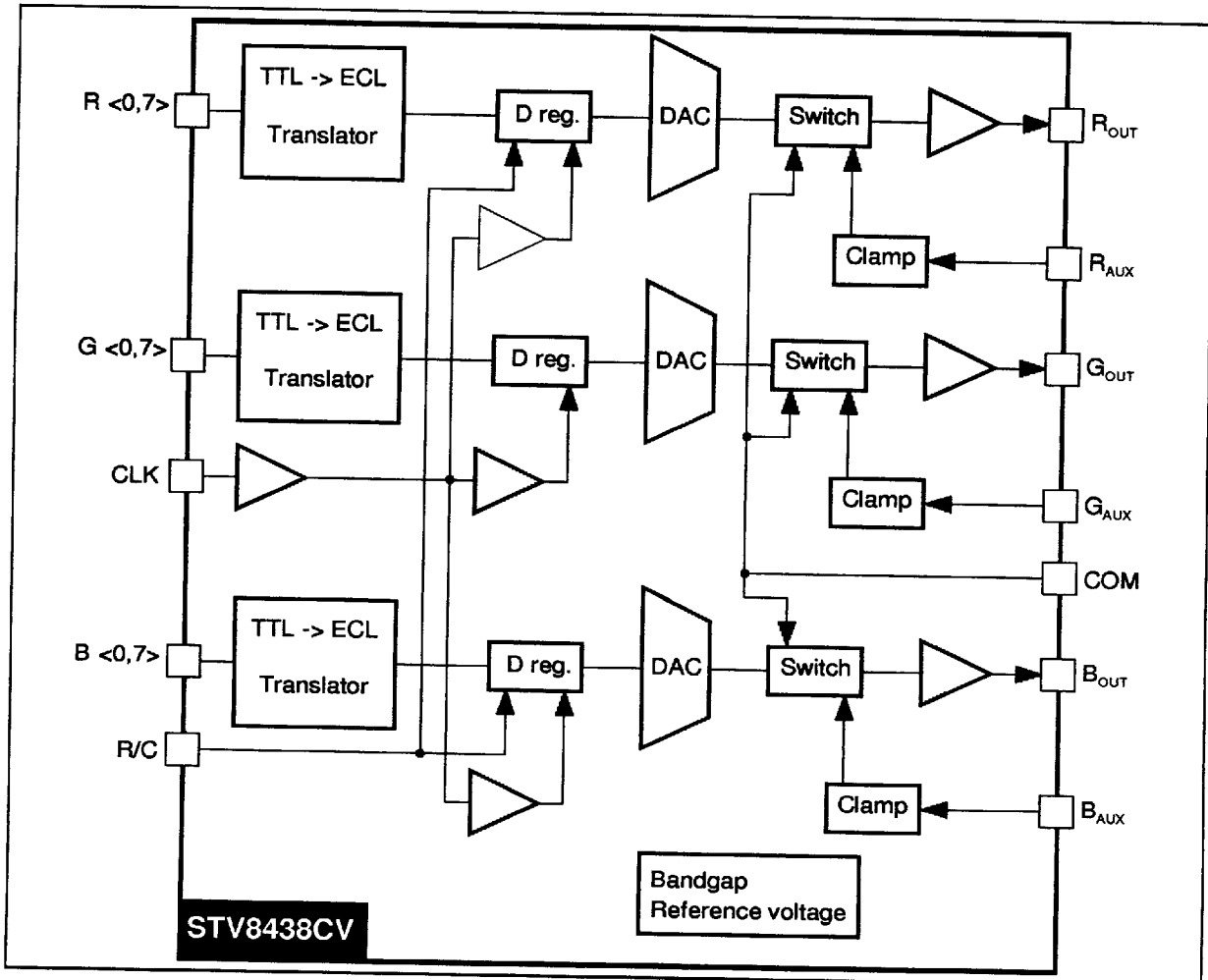
COM : Digital or analog inputs selection

This TTL input selects on the output stage the signal from the D/A converter or the signal from the external analog input. The three internal analog switches are activated by the COM signal.

COM = 0 connects auxiliary analog inputs to output amplifier.

COM = 1 connects internal digital channel to output amplifier.

BLOCK DIAGRAM



CIRCUIT DESCRIPTION

The STV8438CV is designed with 3 identical D/A converters. Each D/A converter is composed of two 4-bit DACs separated by a current divider. The elementary DAC is composed of multiple identical current switches supplied with the same current allowing high speed conversion rate.

DIGITAL INPUT CHANNELS

The STV8438CV supports binary coding on the 3 R, G, B, input channels when R/C pin is high. When R/C pin is low, a 2's complement coding is applied to the R and B channels this provides the capability to use the STV8438CV with luminance and chrominance coded signal; the luminance signal (usually called Y) being applied to the G channel, the

chrominance signals (called U, V) being applied respectively to the R and B channels.

The input range on Y signal is 0/255 and the input range on both U, V signals is -128/+127. For both binary coding and 2's complement coding the output voltage is in the range of 1.685V for the lowest code to 3.315V for the highest code.

ANALOG INPUT CHANNELS

The STV8438CV provides the capability to switch the output voltage from signals coming from the digital channels or from signals coming from auxiliary analog inputs. When COM signal is low, the auxiliary analog signals are connected to the output amplifier internally clamped to the 16th digital step. When COM signal is high, the digital inputs after D/A conversion are connected to the output amplifier.

STV8438CV

ANALOG OUTPUTS

The output voltage amplifiers have an output range of 1.685V to 3.315V. The 1.685V corresponds to the binary code 0 (R/C = 1) or to the 2's complement code -128 (R/C = 0). The 3.315V corresponds

to the maximum value on the digital code 255 if R/C = 1, +127 if R/C = 0.

The STV8438CV provides a step of 6.39mV per LSB. Using the analog input signal (COM = 0), the output amplifier has a gain of 2.

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{CC}	Supply Voltage	8	V
P _{tot}	Power Dissipation	1.8	W
T _{oper}	Operating Temperature	-40 to 85	°C
T _{stg}	Storage Temperature	-55 to 150	°C

8438C-02.TBL

DC ELECTRICAL CHARACTERISTICS (temperature 0 to 70°C, V_{CC} ±5%)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V _{CC}	Supply Voltage	4.75	5	5.25	V
I _{CC}	Supply Current		170		mA
	Resolution			8	Bit
V _{OUTF}	Full Scale Output Voltage		3.315		V
V _{OUTZ}	Zero Scale Output Voltage		1.685		V
DL	Differential Linearity Error			±0.5	LSB
IL	Integral Linearity Error			1	LSB
	Gain Conversion Error between RGB			±2	%
P _D	Power Dissipation		850		mW

8438C-03.TBL

AC ELECTRICAL CHARACTERISTICS (temperature 0 to 70°C, V_{CC} ±5%)

Symbol	Parameter	Min.	Typ.	Max.	Unit
--------	-----------	------	------	------	------

ANALOG OUTPUTS

	Maximum Data Conversion Rate	70			MspS
t _s	Settling Time			14 28.5	ns
	Figure 1 Figure 2				
	Monotonicity			Guaranteed	
	Glitch Energy			80	pV _S
t _{PD}	Propagation Delay (Figures 1 and 2)			4	ns
	Crosstalk between any Outputs (f _{CLK} = 25MHz, input voltage 0.7V _{PP})	50			dB
	Crosstalk between any outputs when auxiliary analog inputs are selected (f _{CLK} = 25MHz, 0.7V _{PP})	50			dB
R _{LOAD}	Output Load (AC coupled - see typical application diagram)	100	150		Ω
V _{OUT}	Output Voltage Range (on 150Ω AC coupled)		1.63		V _{PP}

AUXILIARY ANALOG RGB INPUTS

t _{sw}	Switching-time DAC/Analog Input (Figure 3)			5	ns
	Black Level Clamp Error			±2.5	%
	Crosstalk between any Outputs (f = 5MHz, input voltage 0.7V _{PP})	50			dB
	Crosstalk between RGB Analog Inputs and D/A Outputs (f = 5MHz, input voltage 0.7V _{PP})	50			dB

8438C-04.TBL

AC ELECTRICAL CHARACTERISTICS (temperature 0 to 70°C, $V_{CC} \pm 5\%$) (continued)

Symbol	Parameter	Min.	Typ.	Max.	Unit
--------	-----------	------	------	------	------

ANALOG OUTPUTS FROM ANALOG INPUTS

G	Voltage Gain at $f=1\text{MHz}$ (input voltage $0.7V_{PP}$)		2.0		
B _{Na}	Bandwidth (-3dB)	100			MHz
	Slew-rate (input pulse $0.7V_{PP}$)	120	150		V/ μs
	Harmonic Distortion rate at 1MHz			0.2	%

DIGITAL INPUTS

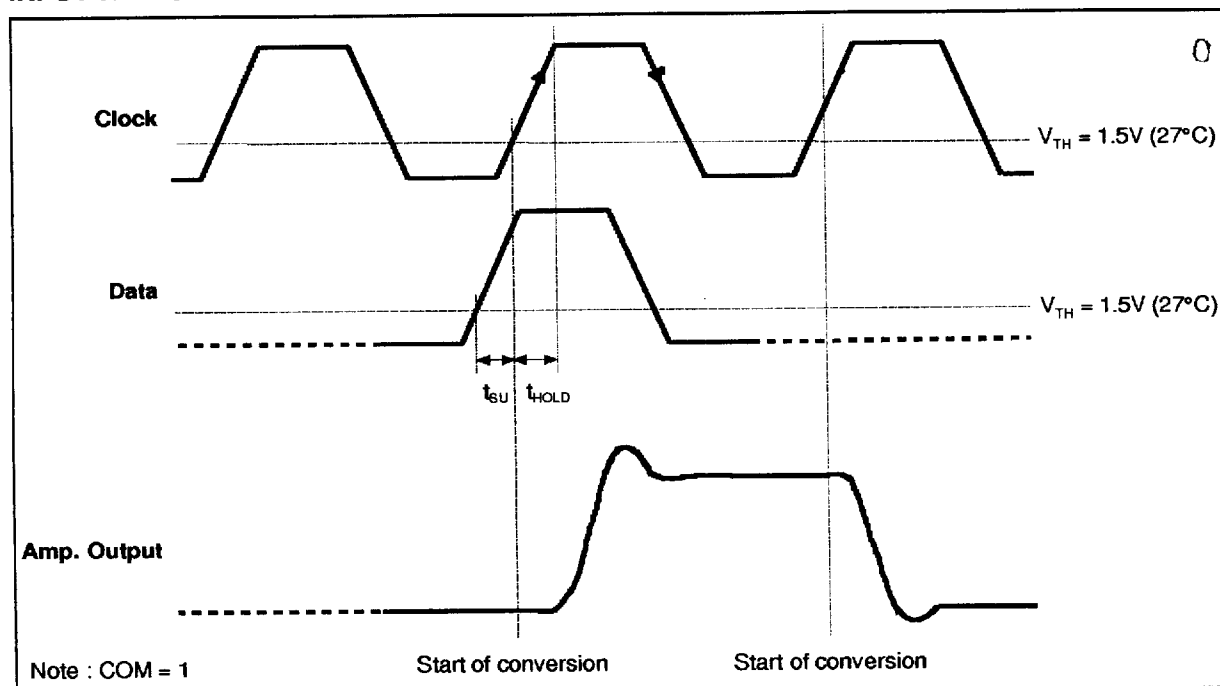
V_{IN}	Input Voltage High Level	2			V
V_{IL}	Input Voltage Low Level			0.8	V
I_{IH}	Input Current High Level			10	μA
I_{IL}	Input Current Low Level	-500			μA

SWITCHING CHARACTERISTICS

FCK	Clock Rate		100		MHz
	Clock Duty-cycle Rate		50		%
t_{CKR}	Clock Rise-time (10% - 90%)			3.5	ns
t_{CKF}	Clock Fall-time (90% - 10%)			3.5	ns
t_{SU}	Data Set-up Time to CLK	2.5			ns
t_{HOLD}	Data Hold-time from CLK	2.5			ns
t_D	Data Conversion Delay		1		cycle

8438C-05.TBL

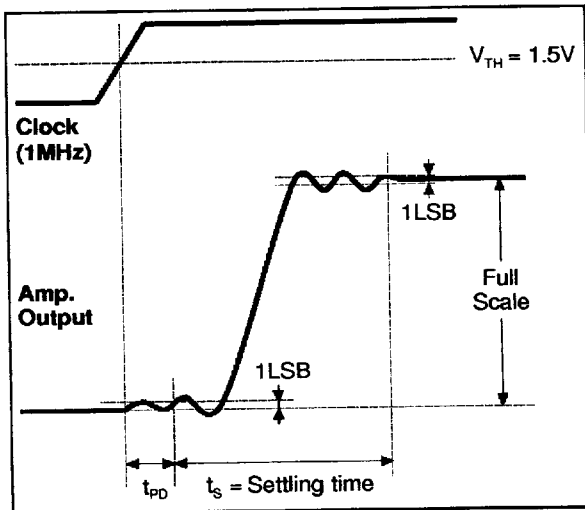
INPUT TIMING DIAGRAM



8438C-03.EPS

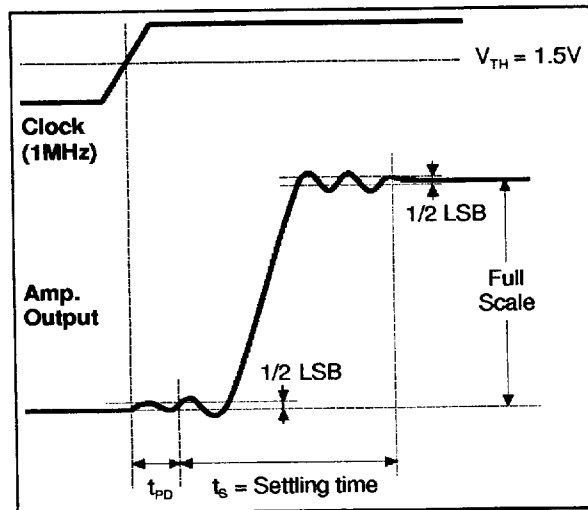
SETTLING TIME MEASUREMENTS

Figure 1



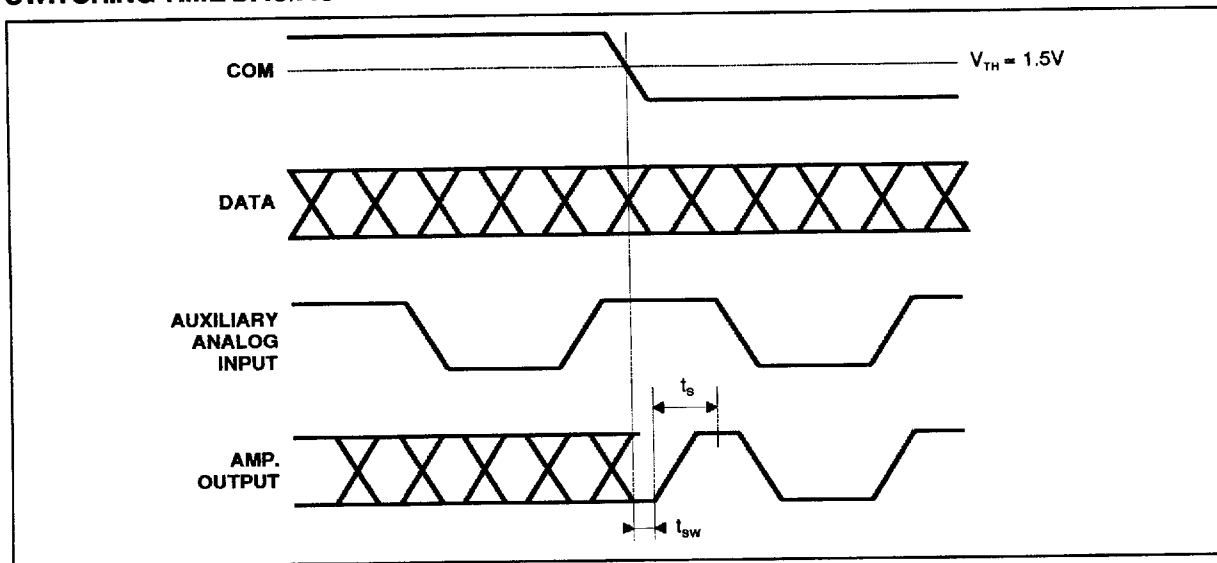
8438C-04.EPS

Figure 2



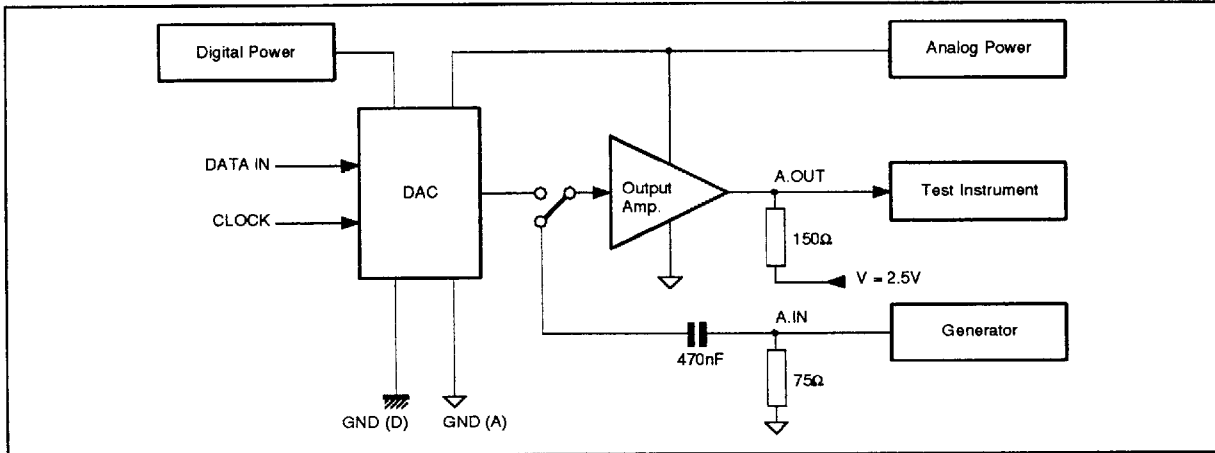
8438C-05.EPS

SWITCHING TIME DAC/AUXILIARY ANALOG INPUT MEASUREMENT



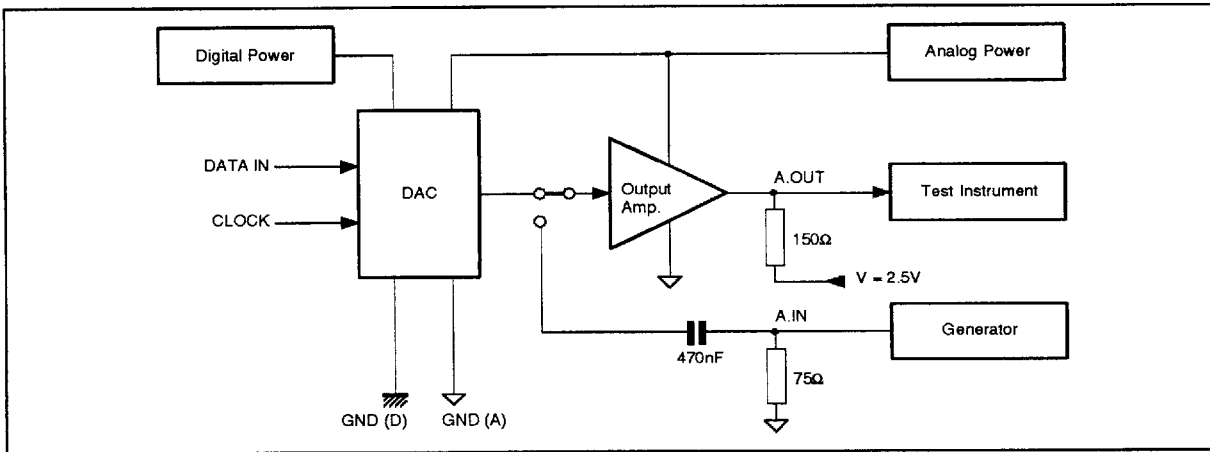
8438C-06.EPS

ANALOG-TEST SCHEMATICS



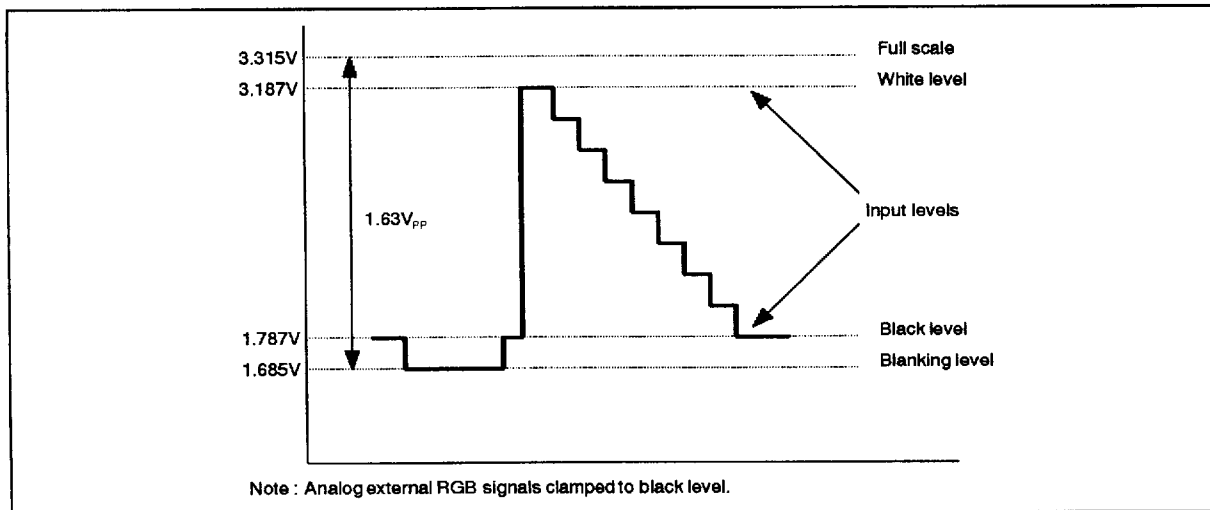
8438C-07.EPS

DAC-TEST SCHEMATICS



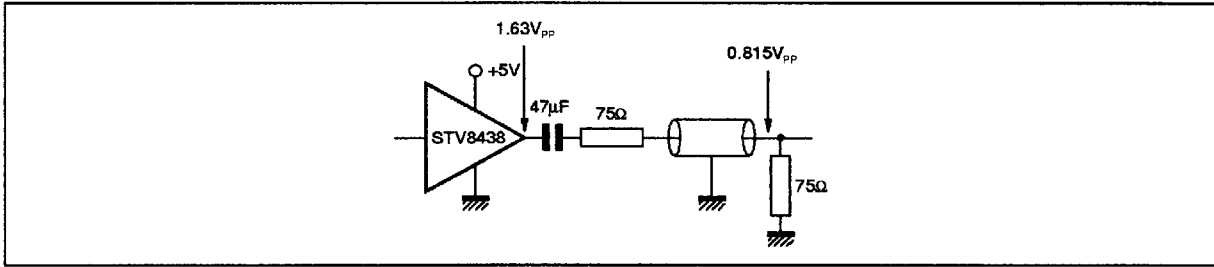
8438C-08.EPS

VOLTAGE AT BUFFER OUTPUT



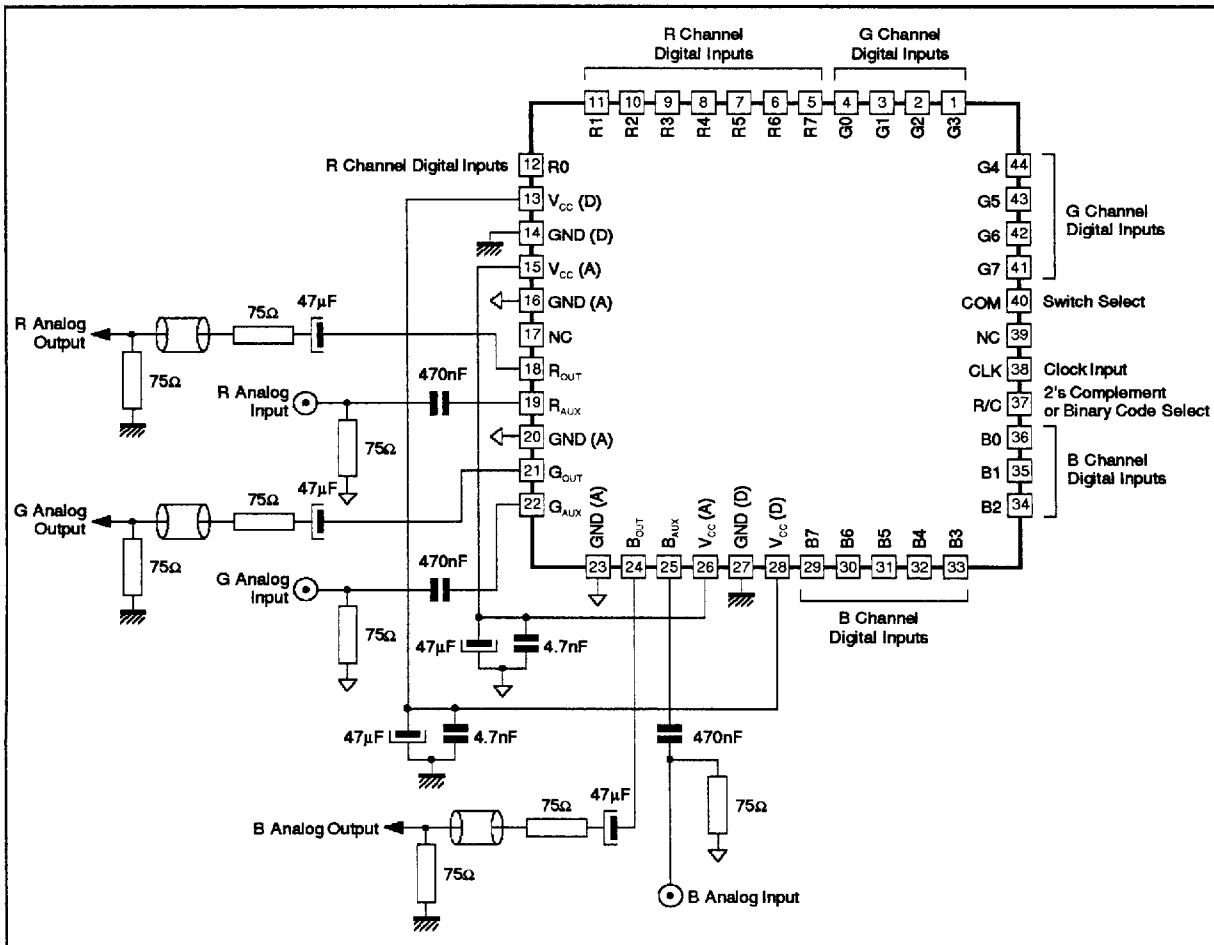
8438C-09.EPS

OUTPUT 75Ω MATCHING



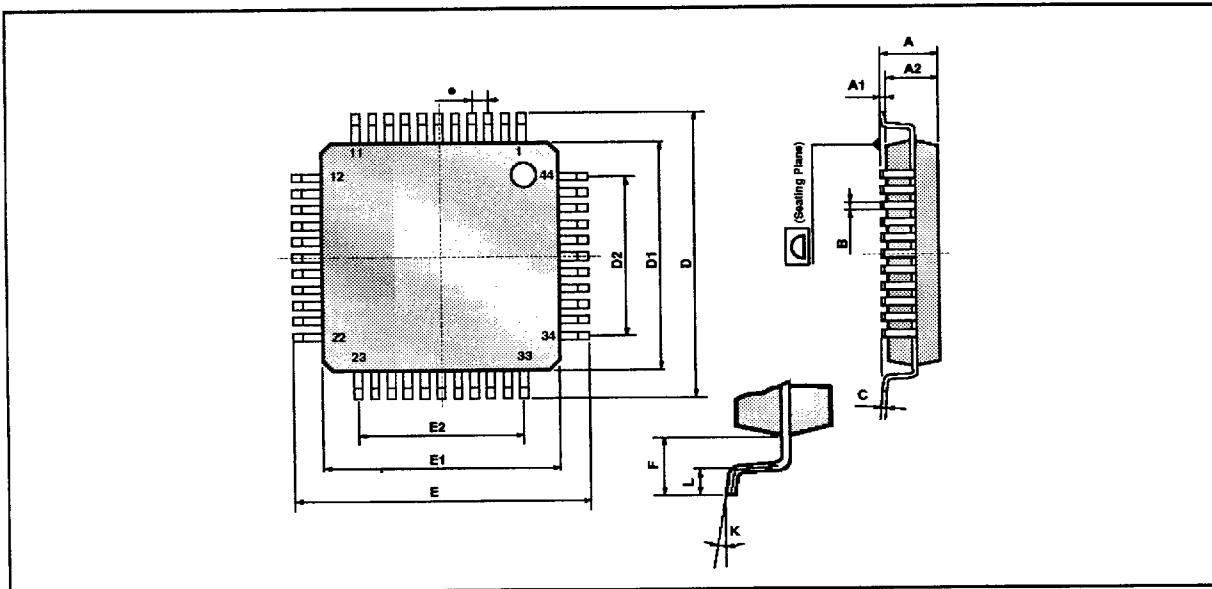
8438C-10.EPS

TYPICAL APPLICATION



8438C-11.EPS

PACKAGE MECHANICAL DATA
44 PINS - PLASTIC QUAD FLAT PACK



PMPOFP44.EPS

Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			3.40			0.134
A1	0.25			0.01		
A2	2.55	2.80	3.05	0.10	0.11	0.12
B	0.35		0.50	0.014		0.020
C	0.13		0.23	0.005		0.009
D	16.95	17.20	17.45	0.667	0.677	0.687
D1	13.90	14.00	14.10	0.547	0.551	0.555
D2		10.00			0.394	
e		1.00			0.039	
E	16.95	17.20	17.45	0.667	0.677	0.687
E1	13.90	14.00	14.10	0.547	0.551	0.555
E2		10.00			0.394	
F		1.60			0.063	
K	0° (min.), 7° (max.)					
L	0.65	0.80	0.95	0.025	0.031	0.037

PQFP44.TBL

Information furnished is believed to be accurate and reliable. However, SGS-THOMSON Microelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No licence is granted by implication or otherwise under any patent or patent rights of SGS-THOMSON Microelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. SGS-THOMSON Microelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of SGS-THOMSON Microelectronics.

© 1995 SGS-THOMSON Microelectronics - All Rights Reserved

Purchase of I²C Components of SGS-THOMSON Microelectronics, conveys a license under the Philips I²C Patent. Rights to use these components in a I²C system, is granted provided that the system conforms to the I²C Standard Specifications as defined by Philips.

SGS-THOMSON Microelectronics GROUP OF COMPANIES

Australia - Brazil - China - France - Germany - Hong Kong - Italy - Japan - Korea - Malaysia - Malta - Morocco
 The Netherlands - Singapore - Spain - Sweden - Switzerland - Taiwan - Thailand - United Kingdom - U.S.A.