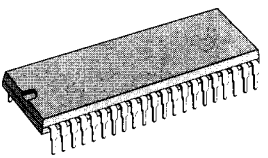
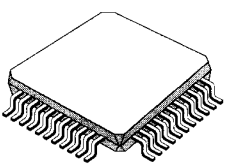
TRIPLE 8-BIT D/A CONVERTER

- 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
- 850 mW POWER DISSIPATION
- OPERATING TEMPERATURE RANGE $0^{\circ}C$ to + $70^{\circ}C$



SHRINK 42
(Plastic Package)

ORDER CODE : STV8438



PQFP 44
(Plastic Package)

ORDER CODE : STV8438CV

DESCRIPTION

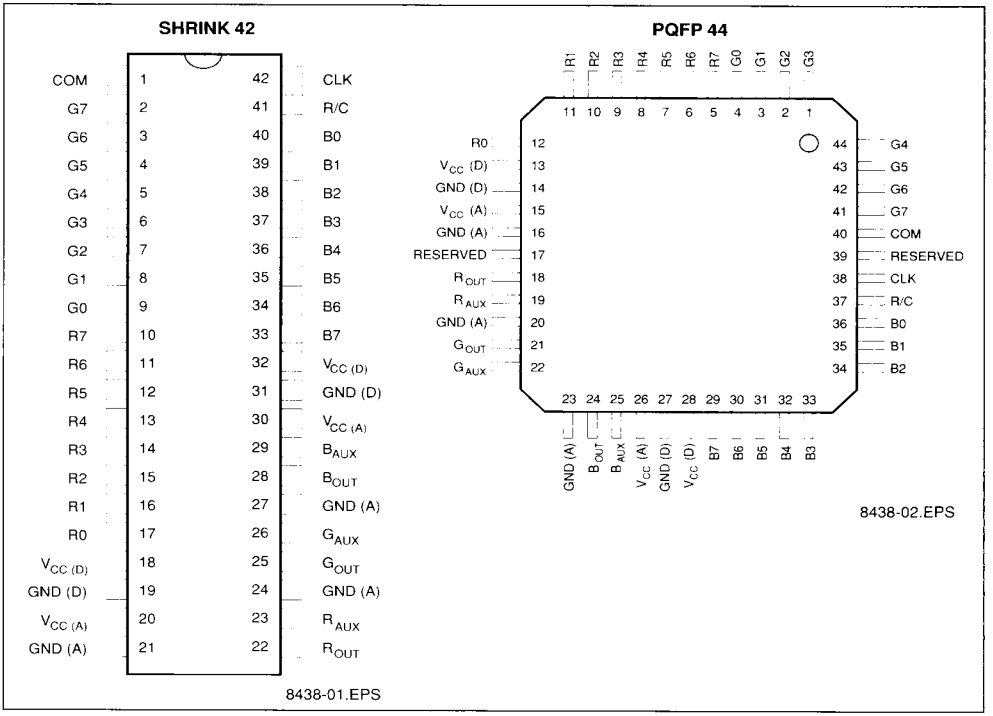
This Digital-to-Analog converter is a monolithic voltage output converter which can accept TTL-level digital input voltages.

The STV8438 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.

PIN CONNECTIONS



PIN ASSIGNMENT (SHRINK 42)

N° Pin Number	Symbol	Type	Function
1	COM	I	Analog switch selection
2 to 9	G < 0:7>	I	Digital input channel G
10 to 17	R < 0:7>	I	Digital input channel R
18 to 32	V_{CC} (D)	I	Digital power supply
19 to 31	GND (D)	I	Digital ground
20 to 30	V_{CC} (A)	I	Analog power supply
21	GND (A)	I	Analog R channel ground
22	R_{OUT}	O	Analog output, R channel
23	R_{AUX}	I	Auxiliary analog input, R channel
24	GND (A)	I	Analog G channel ground
25	G_{OUT}	O	Analog output, G channel
26	G_{AUX}	I	Auxiliary analog input, G channel
27	GND (A)	I	Analog B channel ground
28	B_{OUT}	O	Analog output, B channel
29	B_{AUX}	I	Auxiliary analog input, B channel
33 to 40	B < 0:7>	I	Digital input channel B
41	R/C	I	Binary or 2's complement selection
42	CLK	I	Clock input

8438-01.TBL

PIN DESCRIPTION

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

G <0:7> : Digital input channel G
These TTL 8-Bit input data are sampled on the rising edge of the clock CLK. G_0 is the LSB and G_7 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. R_0 is the LSB and R_7 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. B_0 is the LSB and B_7 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 Rout 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 amplfier 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} it the COM signal is low.

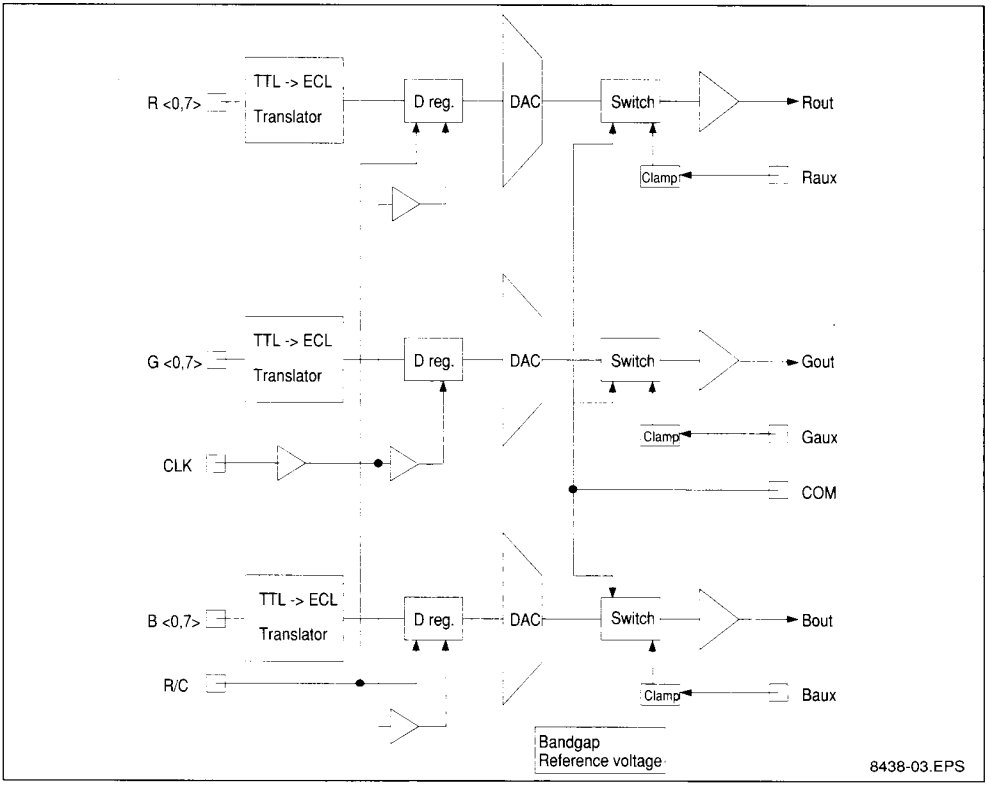
GOUT : Analog output, G channel
This voltage analog output corresponds to the digital channel G if the COM signal is high or to the auxiliary analog input G_{AUX} if the COM signal is low.

BOUT : 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.

BLOCK DIAGRAM



CIRCUIT DESCRIPTION

The STV8438 is designed with 3 identical D/A converters. Each D/A converter is constituted 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 STV8438 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 STV8438 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. Whatever binary coding or 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 STV8438 provides the capability to switch the output voltage from signals coming from the digital channels or from signal coming from auxiliary analog inputs. When COM signal is low, the auxiliary analog signals are connected to the output amplifier internaly clamped to the 16th digital step. When COM signal is high, the digital inputs after D/A conversion are connected to the output amplifier.

ANALOG OUTPUTS

The output voltage amplifiers have an output range of 1.685V to 3.315V. The 1.685V corresponds to the binary code Ø (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 = 0, +127 if R/C = 1.

The STV8438 provides a step if 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

8438-02.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

8438-03.TBL

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

Symbol	Parameter	Min.	Typ.	Max.	Unit
ANALOG OUTPUTS					
	Maximum Data Conversion Rate	70			Msps
t_S	Settling Time Figure 1 Figure 2			 14 28.5	ns
	Monotonicity	Guaranteed			
	Glitch Energy			80	pVs
t_{PD}	Propagation Delay (Figures 1 and 2)			4	ns
	Crosstalk between Any Outputs (f_{CLK} = 25MHz-input voltage.7V_{pp})	50			dB
	Crosstalk between any outputs when auxiliary analog inputs are selected (f_{CLK} = 25MHz .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.7V_{pp})	50			dB
	Crosstalk between RGB Analog Inputs and D/A Outputs (f = 5MHz-input voltage.7Vpp)	50			dB

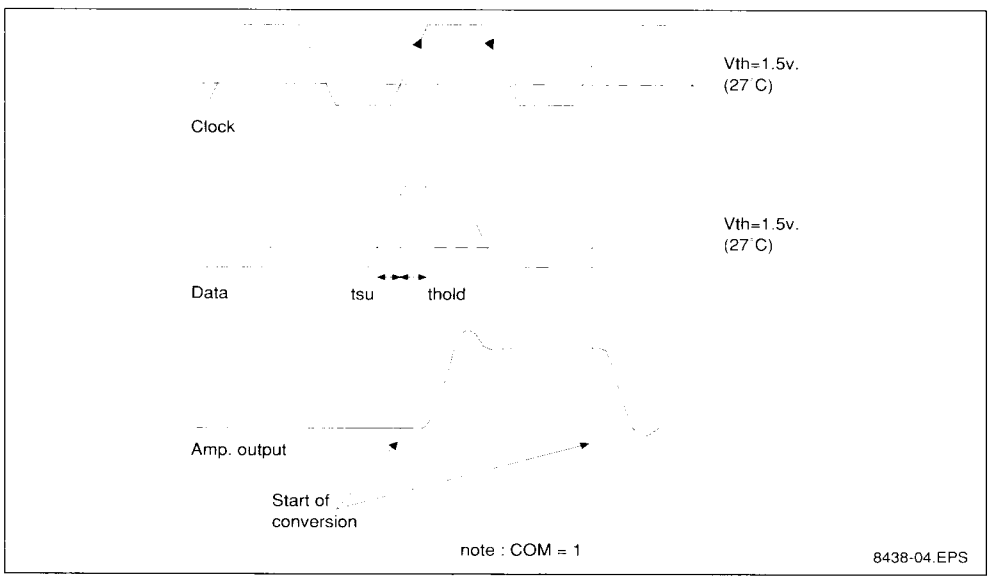
8438-04.TBL

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

Symbol	Parameter	Min.	Typ.	Max.	Unit
ANALOG OUTPUTS FROM ANALOG INPUTS					
G	Voltage gain at f=1MHz (input voltage .7Vpp)		2.0		
BNa	Band-width (-3dB)	100			MHz
	Slew-rate (inp. pulse 0.7Vpp)	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}	Inpur 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

8438-05.TBL

INPUT TIMING DIAGRAM



SETTLING TIME MEASUREMENTS

Figure 1

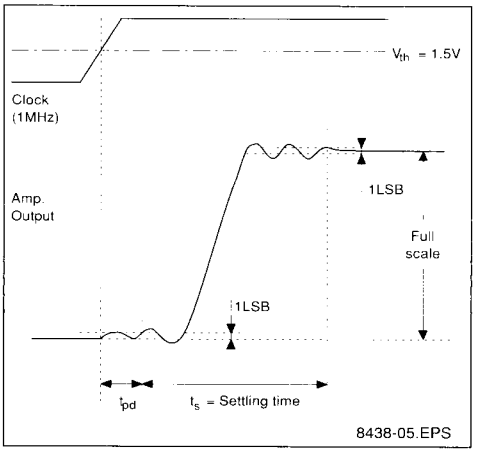
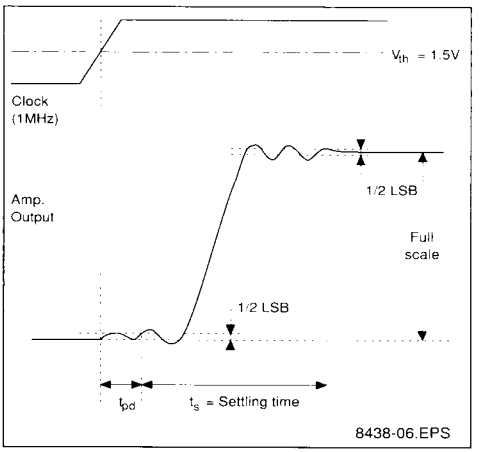
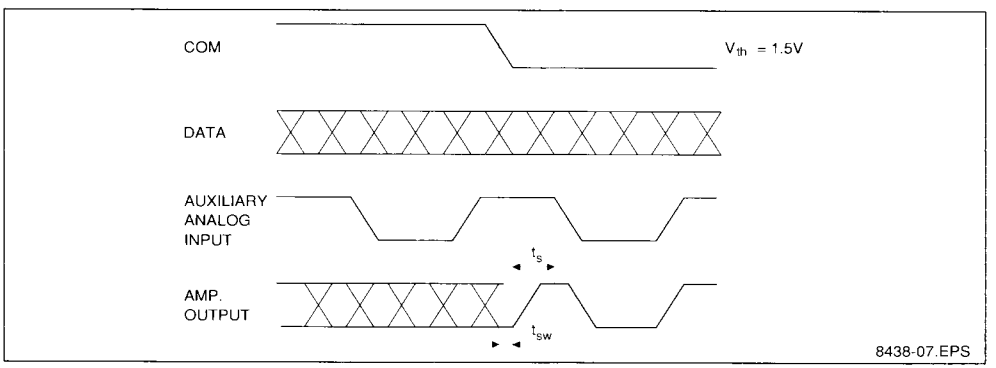


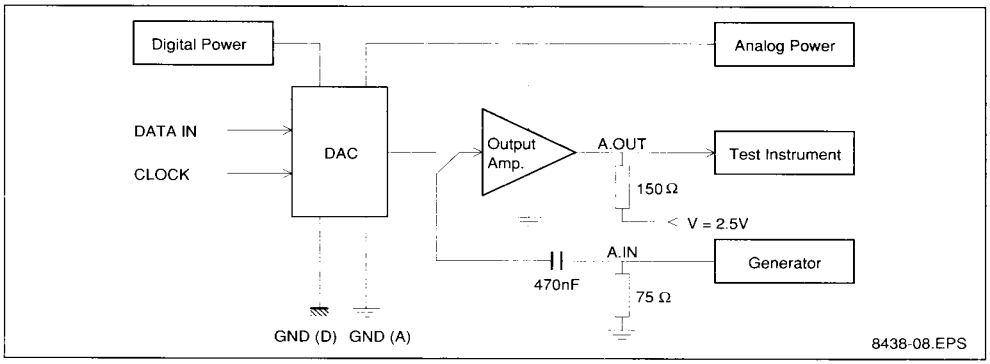
Figure 2



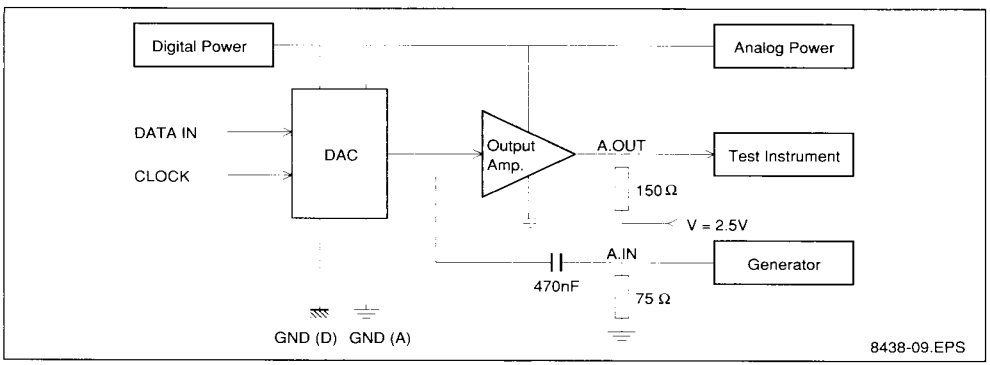
SWITCHING TIME DAC/AUXILIARY ANALOG INPUT MEASUREMENT



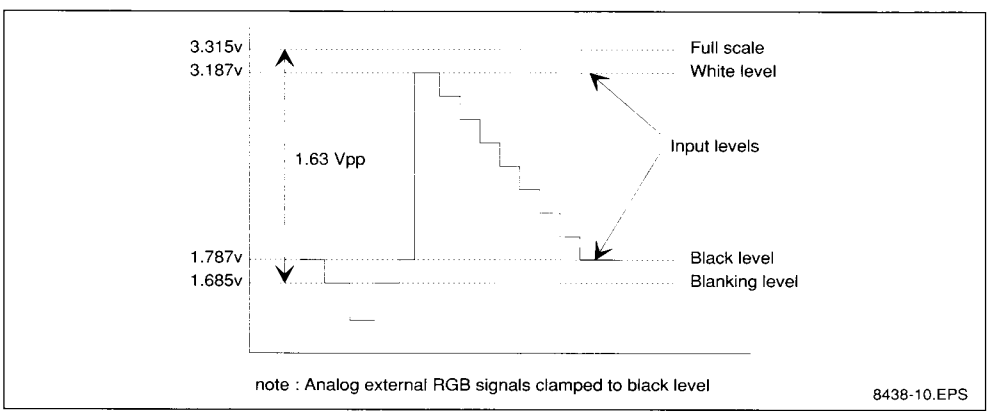
ANALOG-TEST SCHEMATICS



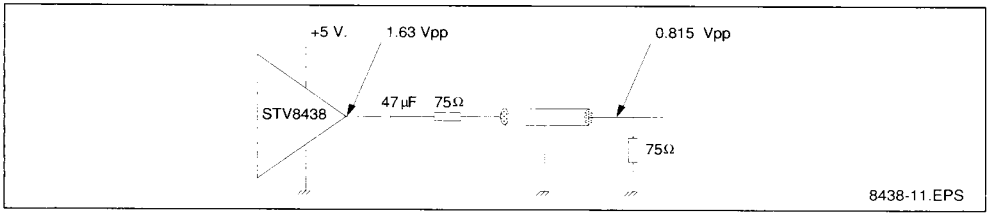
DAC-TEST SCHEMATICS



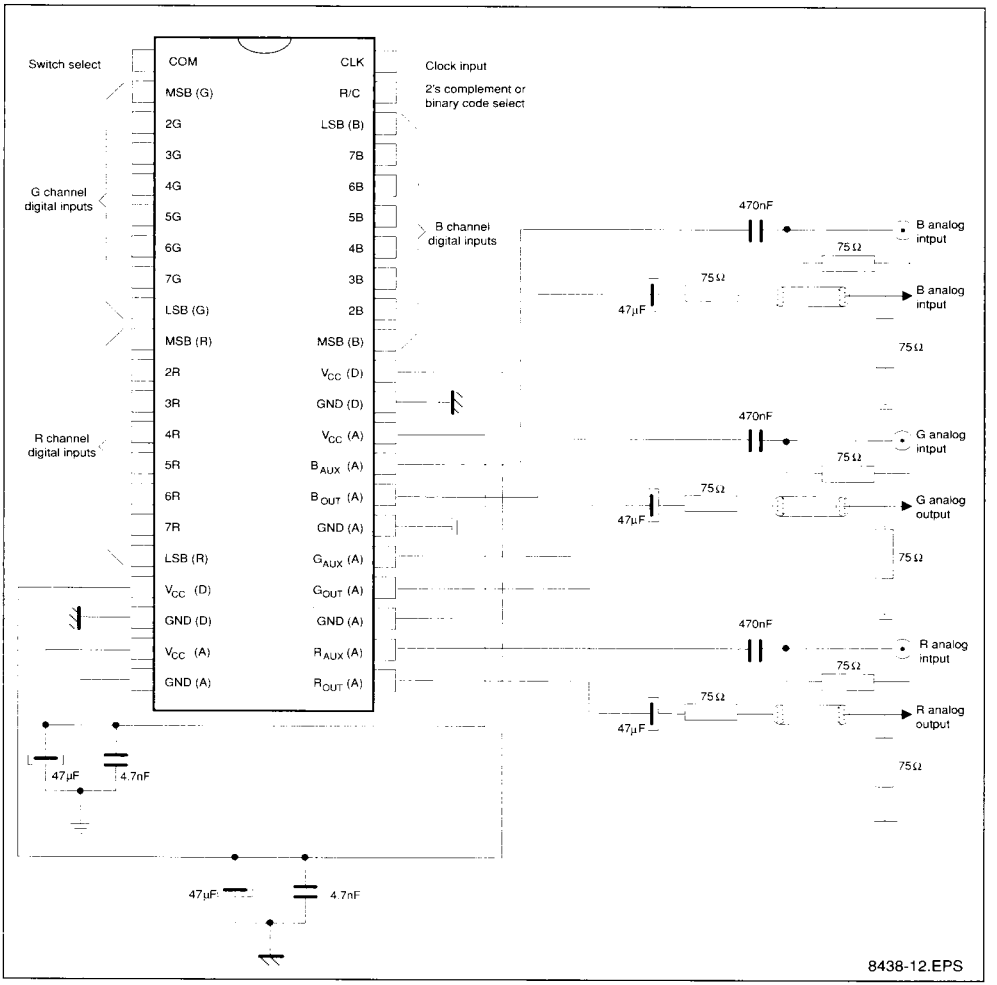
VOLTAGE AT BUFFER OUTPUT



OUTPUT 75Ω MATCHING

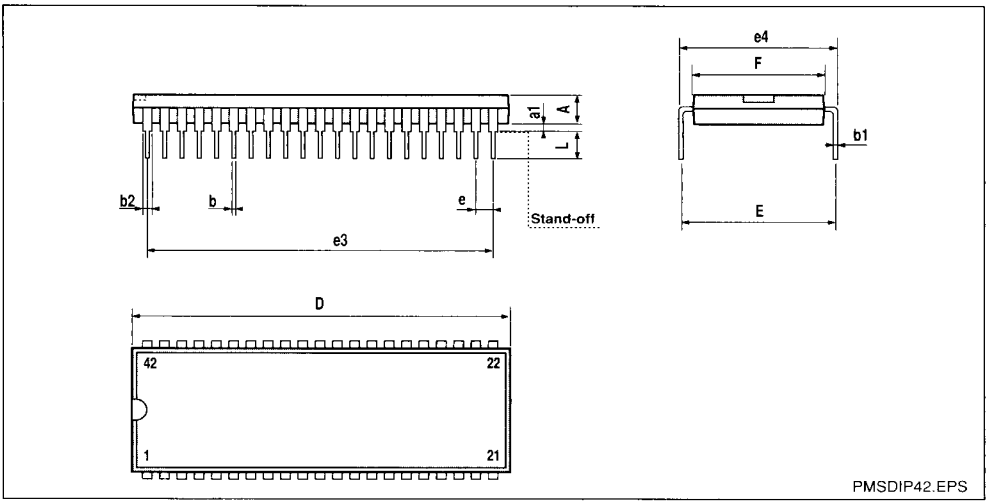


TYPICAL APPLICATION



PACKAGE MECHANICAL DATA

42 PINS - PLASTIC SHRINK DIP

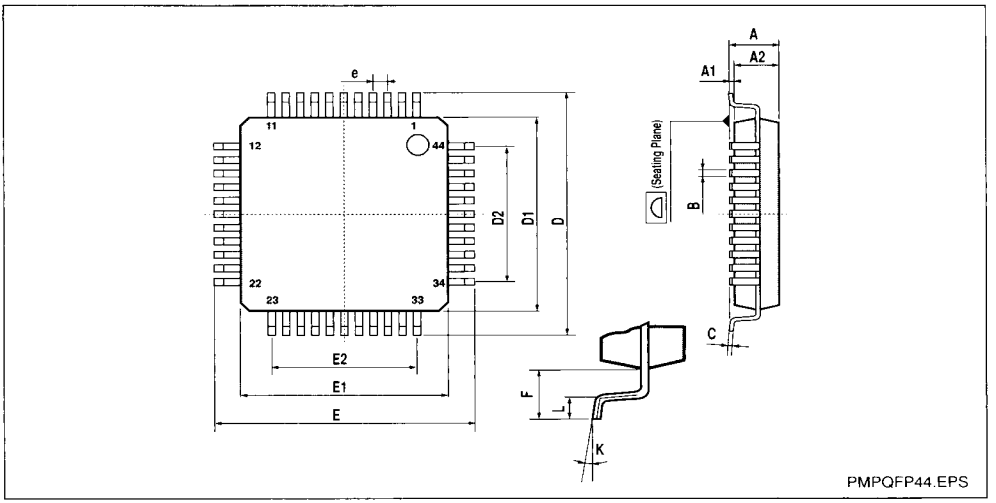


Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			4.83			0.190
a1	0.51			0.020		
b	0.38	0.46	0.56	0.015	0.018	0.022
b1	0.20	0.25	0.30	0.008	0.010	0.012
b2	0.76	1.02	1.27	0.030	0.040	0.050
b3		0.75			0.030	
D	36.70	36.83	36.96	1.445	1.450	1.455
E		15.24			0.600	
e	1.778			0.070		
e3	35.56			1.400		
e4	15.24			0.600		0.625
F	13.46	13.72	13.97	0.530	0.540	0.550
L	3.05		3.43	0.120		0.135

SDIP42B TBL

PACKAGE MECHANICAL DATA

44 PINS - PLASTIC QUAD FLAT PACK



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