

DATA SHEET



MOS INTEGRATED CIRCUIT
μPD6900

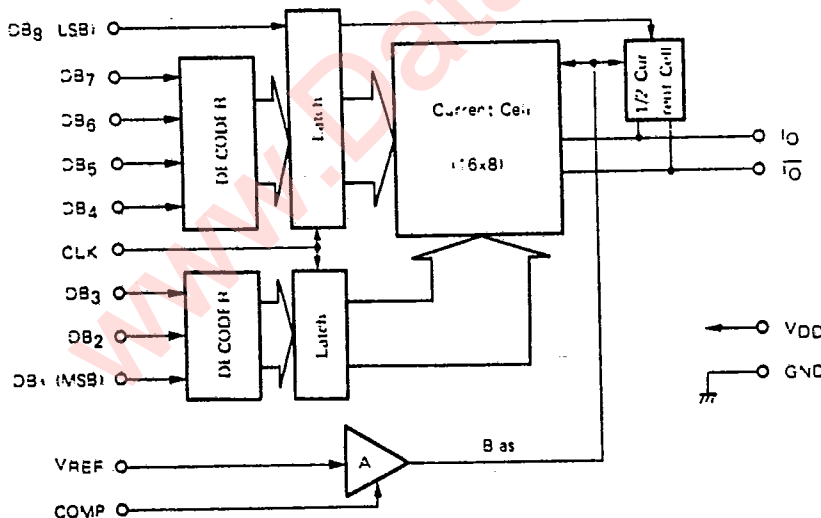
8 bit D/A Converter for Video Signal Processing
CMOS LSI

The μPD6900 is an 8 bit D/A converter for use in video applications. The high-speed CMOS processing technology and the matrix current cell method adopted for this CMOS device have enabled fast conversion rates to be achieved. Conversion rates of up to 20 Msp/s can be attained while operating at low power consumption, making this device ideal for a wide range of applications including digital TV systems and video systems. ★

FEATURES

- Resolution : 8 bits
- Conversion rate : 20 Msp/s
- Linearity : ±1/2 LSB TYP.
- Reference voltage : 2.0 V TYP.
- Power supply voltage : +5 V single
- Low power consumption (150 mW TYP.)
- TTL compatible (Digital inputs)
- 22 pin plastic DIP, and 24 pin plastic SOP (375 mil)

BLOCK DIAGRAM



ORDERING INFORMATION

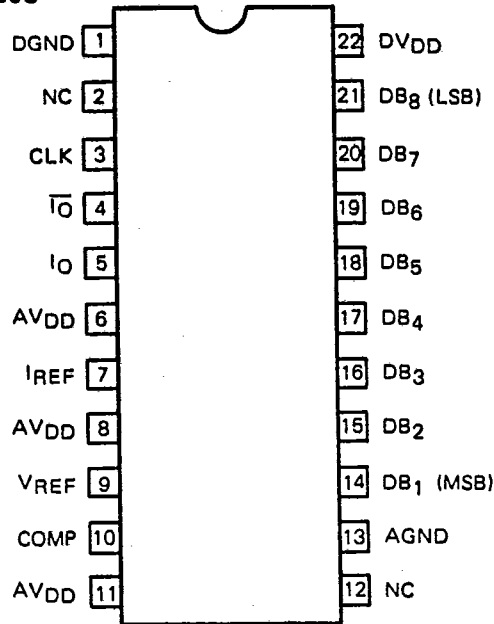
ORDERING CODE	PACKAGE
μPD6900C	22 pin plastic DIP (400 mil)
μPD6900G	24 pin plastic SOJ (375 mil)

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The * mark outside the columns denotes major points where revisions or additions are made in this edition.

CONNECTION DIAGRAM (Top View)

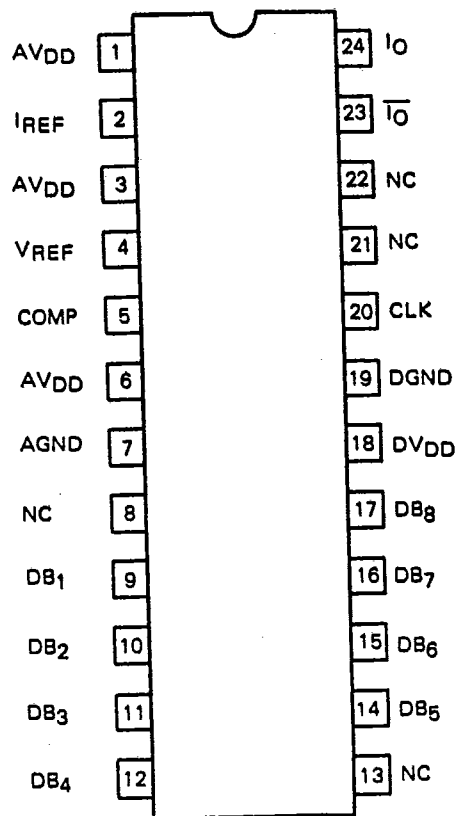
μPD6900C



1	DGND	Digital GND
2	NC	No connection
3	CLK	Sampling clock input
4	$\overline{I_O}$	Complementary current output
5	I_O	Current output
6	AVDD	Analog power supply
7	IREF	Full-scale current adjustment
8	AVDD	Analog power supply
9	VREF	Reference voltage input
10	COMP	Amp compensation
11	AVDD	Analog power supply
12	NC	No connection
13	AGND	Analog GND
14	DB ₁	Digital input (MSB)
15	DB ₂	Digital input (2nd)
16	DB ₃	Digital input (3rd)
17	DB ₄	Digital input (4th)
18	DB ₅	Digital input (5th)
19	DB ₆	Digital input (6th)
20	DB ₇	Digital input (7th)
21	DB ₈	Digital input (LSB)
22	DVDD	Digital power supply

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 μ PD6900G

1	AV _{DD}	Analog power supply
2	I _{REF}	Full-Scale current adjustment
3	AV _{DD}	Analog power supply
4	V _{REF}	Reference voltage input
5	COMP	Amp phase compensation
6	AV _{DD}	Analog power supply
7	AGND	Analog GND
8	NC	No connection
9	DB ₁	Digital input (MSB)
10	DB ₂	Digital input (2nd)
11	DB ₃	Digital input (3rd)
12	DB ₄	Digital input (4th)
13	NC	No connection
14	DB ₅	Digital input (5th)
15	DB ₆	Digital input (6th)
16	DB ₇	Digital input (7th)
17	DB ₈	Digital input (LSB)
18	DV _{DD}	Digital power supply
19	DGND	Digital GND
20	CLK	Sampling clock input
21	NC	No connection
22	NC	No connection
23	$\overline{I_O}$	Complementary current output
24	I _O	Current output

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ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Power supply voltage	-0.3 to +7.0	V
Input terminal voltage	-0.3 to $V_{DD}+0.3$	V
Output terminal voltage	-0.3 to $V_{DD}+0.3$	V
Analog power supply voltage	$DV_{DD}-0.3$ to $DV_{DD}+0.3$	V
Analog GND voltage	$DGND-0.3$ to $DGND+0.3$	V
Operating temperature range	-20 to +75	$^\circ\text{C}$
Storage temperature range	-40 to +125	$^\circ\text{C}$

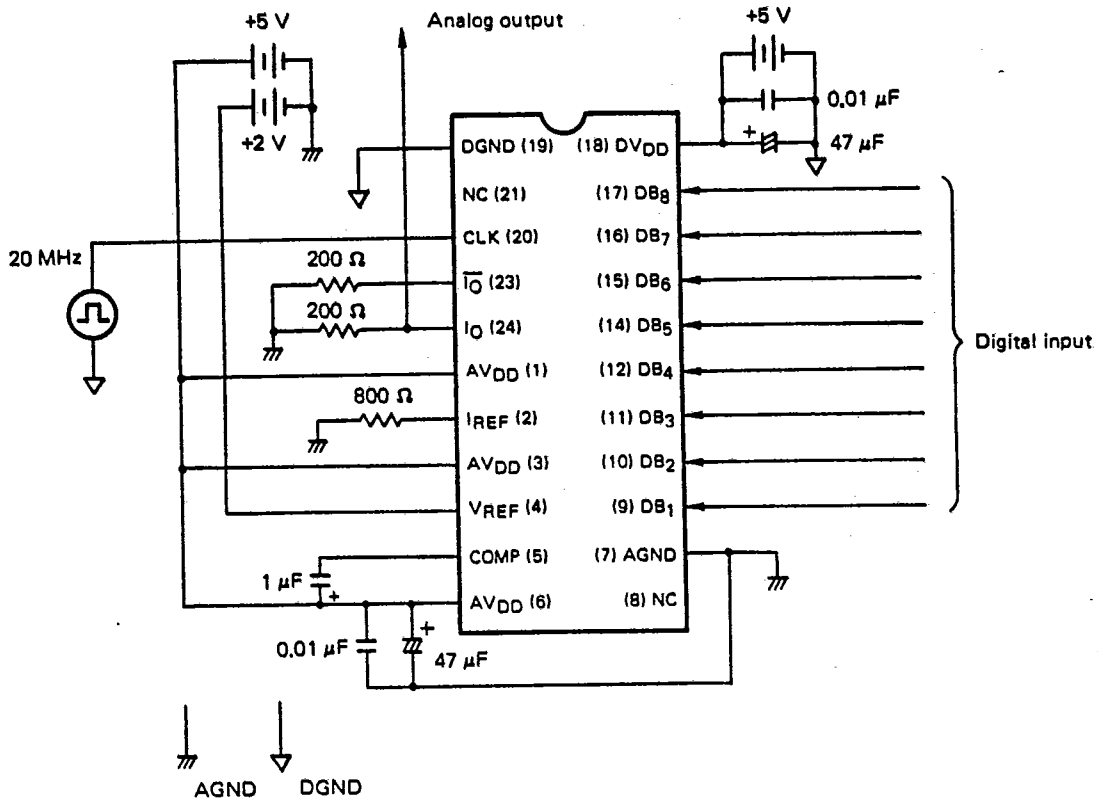
RECOMMENDED OPERATING CONDITIONS ($T_a = -20$ to $+75^\circ\text{C}$)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Power supply voltage	V_{DD}	4.5	5.0	5.5	V	
Reference voltage	V_{REF}	1.8	2.0	2.2	V	
Reference resistance	R_{REF}		800		Ω	
Sampling clock	f_{samp}	DC		20	MHz	
Sampling clock low level pulse width	t_{PWL}	10			ns	
Sampling clock high level pulse width	t_{PWH}	10			ns	
Data set up time	t_{S}	20			ns	
Data hold time	t_{H}	10			ns	
Digital input high level	V_{IH}	2.7			V	
Digital input low level	V_{IL}			0.4	V	
Compensation capacity	C_{COMP}	1.0			μF	

ELECTRICAL CHARACTERISTICS ($T_a = -20$ to $+75^\circ\text{C}$, $V_{DD} = 5\text{ V} \pm 0.5\text{ V}$, $f_{\text{samp}} = 20\text{ MHz}$)

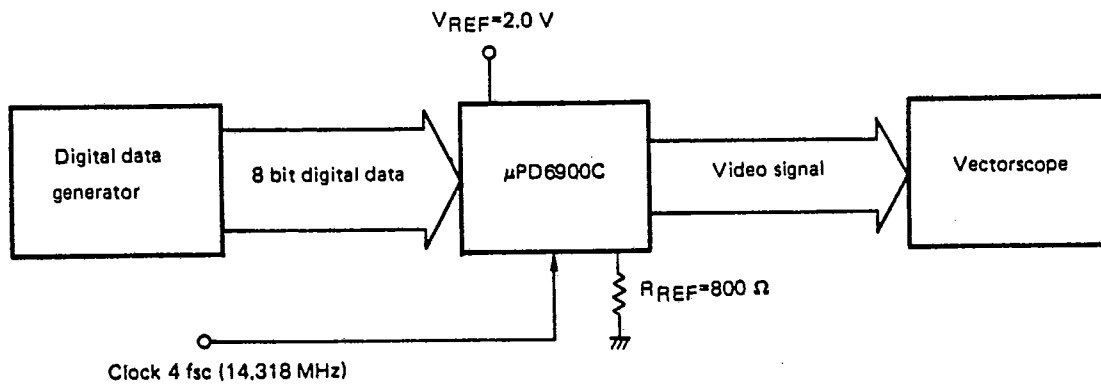
CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Power supply current	I_{DD}		30	50	mA	$V_{DD}=5.0\text{ V}$
Resolution	RES		8		bit	
Non-linearity error	NL		$\pm 1/2$	± 1	LSB	$T_a=0$ to 60°C , $V_{DD}=5\text{ V} \pm 0.25\text{ V}$
Differential non-linearity	DNL		$\pm 1/2$	± 1	LSB	$T_a=0$ to 60°C , $V_{DD}=5\text{ V} \pm 0.25\text{ V}$
Differential gain	DG		3	4	%	$f_{\text{samp}}=14.318\text{ MHz}$, $V_{DD}=5\text{ V} \pm 0.25\text{ V}$
Differential phase	DP		1	3	deg	$f_{\text{samp}}=14.318\text{ MHz}$, $V_{DD}=5\text{ V} \pm 0.25\text{ V}$
Output compliance	V_{O}	2.5	3.0		V	$V_{DD}=5.0\text{ V}$
Analog output delay time	t_{D}		40		ns	
Settling time	t_{SET}		40		ns	
Full-scale current	I_{FS}	9	10	11	mA	$V_{\text{REF}}=2.0\text{ V}$, $R_{\text{REF}}=800\ \Omega$
Zero-scale offset current	I_{ZS}			20	μA	$V_{\text{REF}}=2.0\text{ V}$, $R_{\text{REF}}=800\ \Omega$
Digital input capacitance	C_{DI}			30	pF	
Digital input current	I_{I}			10	μA	

TEST CIRCUIT



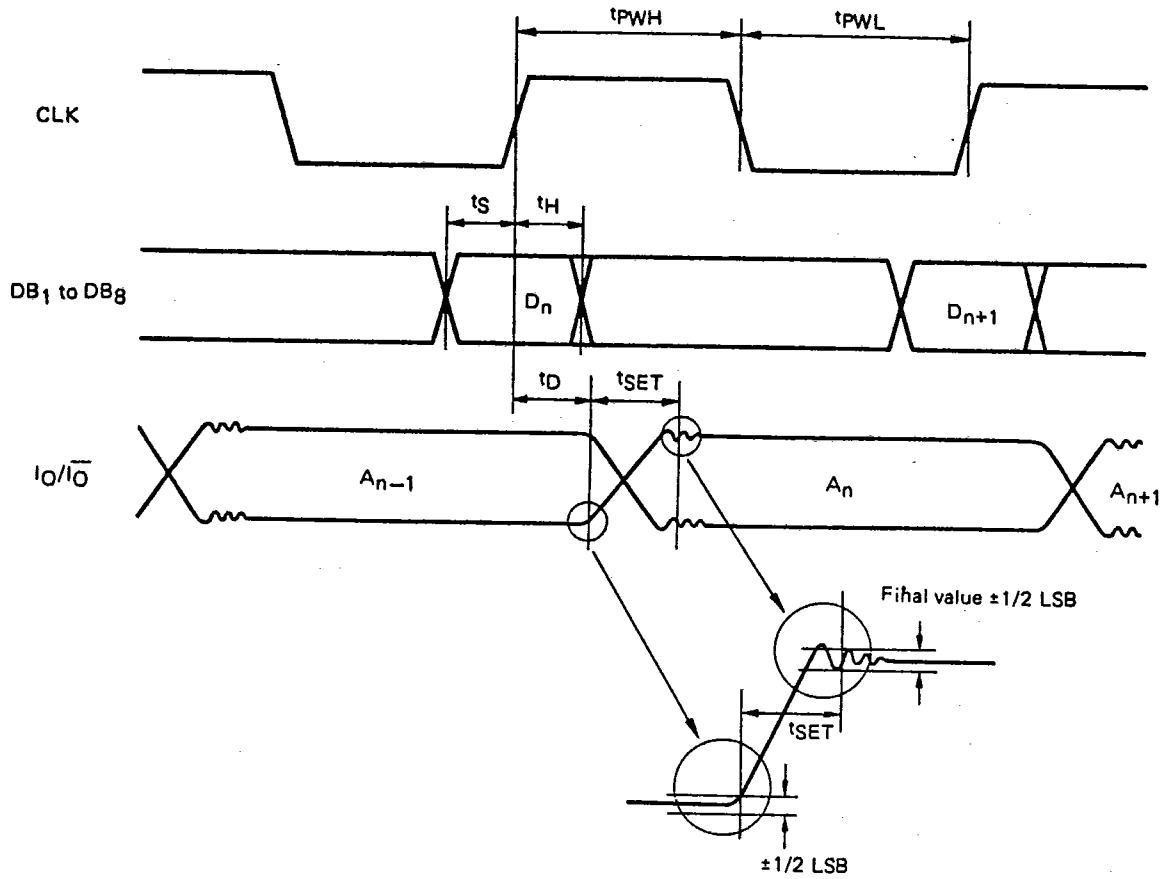
() shows pins number of μPD6900G.

DG AND DP MEASUREMENT BLOCK DIAGRAM



The data from the digital data generator is 40 IRE lamp signal (NTSC) digital data.

TIMING CHART



PIN DESCRIPTIONS

(/) shows pins number. RIGHT one is μ PD6900G's and LEFT one is μ PD6900Q's terminal number.

DGND (Pin 1/19)	Digital system ground
AGND (Pin 13/7)	Analog system ground
DVDD (Pin 22/18)	Digital system power supply (+5 V)
AVDD (Pins 6, 8, 11/1, 3, 6)	Analog system power supply (+5 V)

The digital system power supply and ground is isolated from the analog system power supply and ground in the IC as a precaution against noise. The ground and power supply lines are also isolated on the circuit boards, the analog ground being as wide as possible for better stability.

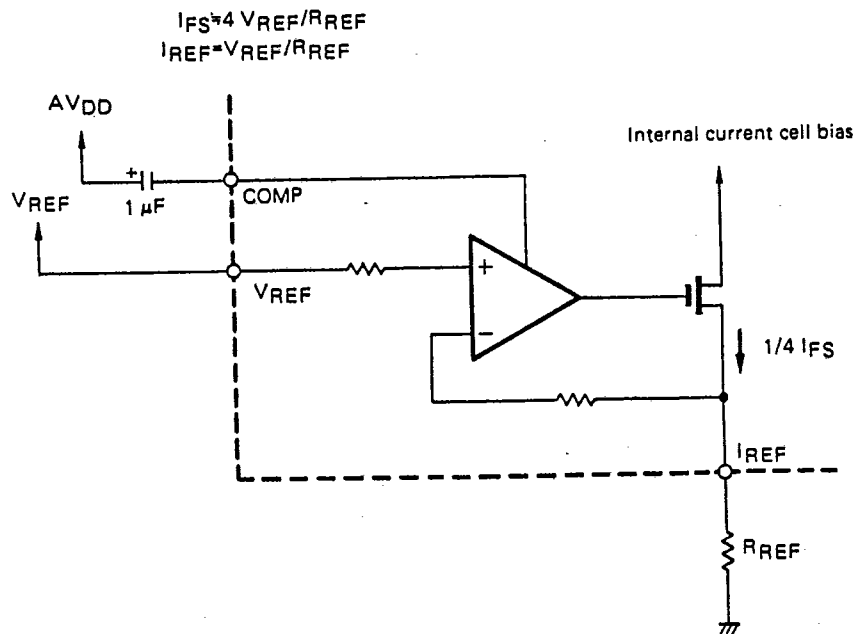
Insert by-pass capacitors of about $0.01 \mu\text{F}$ and $47 \mu\text{F}$ between the analog power line and analog ground, and also between the digital power line and digital ground. These capacitors should be connected as close as possible to the μ PD6900C pins. Supply the digital system power from the analog power line through the low path filter to prevent from lurch up.

I_{REF} (Pin 7/2) Full-scale current adjustment pin

V_{REF} (Pin 9/4) Reference voltage input pin

These pins are used in adjustment of the analog output current (full-scale current).

The analog output current (full-scale current I_{FS}) is set by the reference voltage V_{REF} and the reference resistance R_{REF} connected between the I_{REF} pin and analog ground.



- ★ The recommended reference voltage and reference resistance values are $V_{REF} = 2.0\text{ V}$ and $R_{REF} = 800\ \Omega$ respectively. The output analog current I_{FS} in this case will be 10 mA. Also connect by-pass capacitors of about $0.01\ \mu\text{F}$ and $47\ \mu\text{F}$ between the V_{REF} pin and GND in the same way as the by-pass capacitors connected to the power pins.

COMP (Pin 10/5) Phase compensation capacitor connection

A capacitor for phase compensation of the internal amplifier is connected to this pin. Connect a $1.0\ \mu\text{F}$ capacitor between this pin and analog V_{DD} .

DB₁ to DB₈ (Pins 14 thru 21/9 thru 12, 14 thru 17) Digital data input pins

DB₁ to DB₈ are the 8 bit digital data input pins. The code format is binary, and the input voltage level is TTL compatible.

Digital input code								Analog output current
DB ₁ (MSB)	DB ₂	DB ₃	DB ₄	DB ₅	DB ₆	DB ₇	DB ₈ (LSB)	
0	0	0	0	0	0	0	0	0 note
0	0	0	0	0	0	0	1	$1/256 I_{FS}$
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
1	1	1	1	1	1	0	1	$253/256 I_{FS}$
1	1	1	1	1	1	1	0	$254/256 I_{FS}$
1	1	1	1	1	1	1	1	$255/256 I_{FS}$

note : Excluding offset current

Digital data (DB₁ to DB₈) is latched by the rising edge of the sampling clock, and converted to corresponding analog outputs.

CLK (Pin 3/20) Sampling clock input pin

Digital data is latched by the rising edge of the clock signal applied to the sampling clock input pin, and is subsequently converted to analog outputs. The maximum clock frequency is 20 MHz.

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I_O (Pin 5/24) Analog signal output pin
 $\overline{I_O}$ (Pin 4/23) Analog signal complementary output pin

These two pins are current output pins. The full-scale output current is determined by the reference resistance R_{REF} and reference voltage V_{REF} .

$$I_{FS} = I_O + \overline{I_O} = 4 V_{REF}/R_{REF}$$

$\overline{I_O}$ is the complementary output pin of I_O . The added output current from the I_O and $\overline{I_O}$ pins becomes the full-scale current in accordance with the above equation. Analog output current can be easily converted to an analog output voltage by connecting a resistance between the I_O or $\overline{I_O}$ pin and analog ground. In this case resistances must also be connected to the I_O and $\overline{I_O}$ pins.

NC (Pins 2 and 12/8, 3, 21, 22) No connection

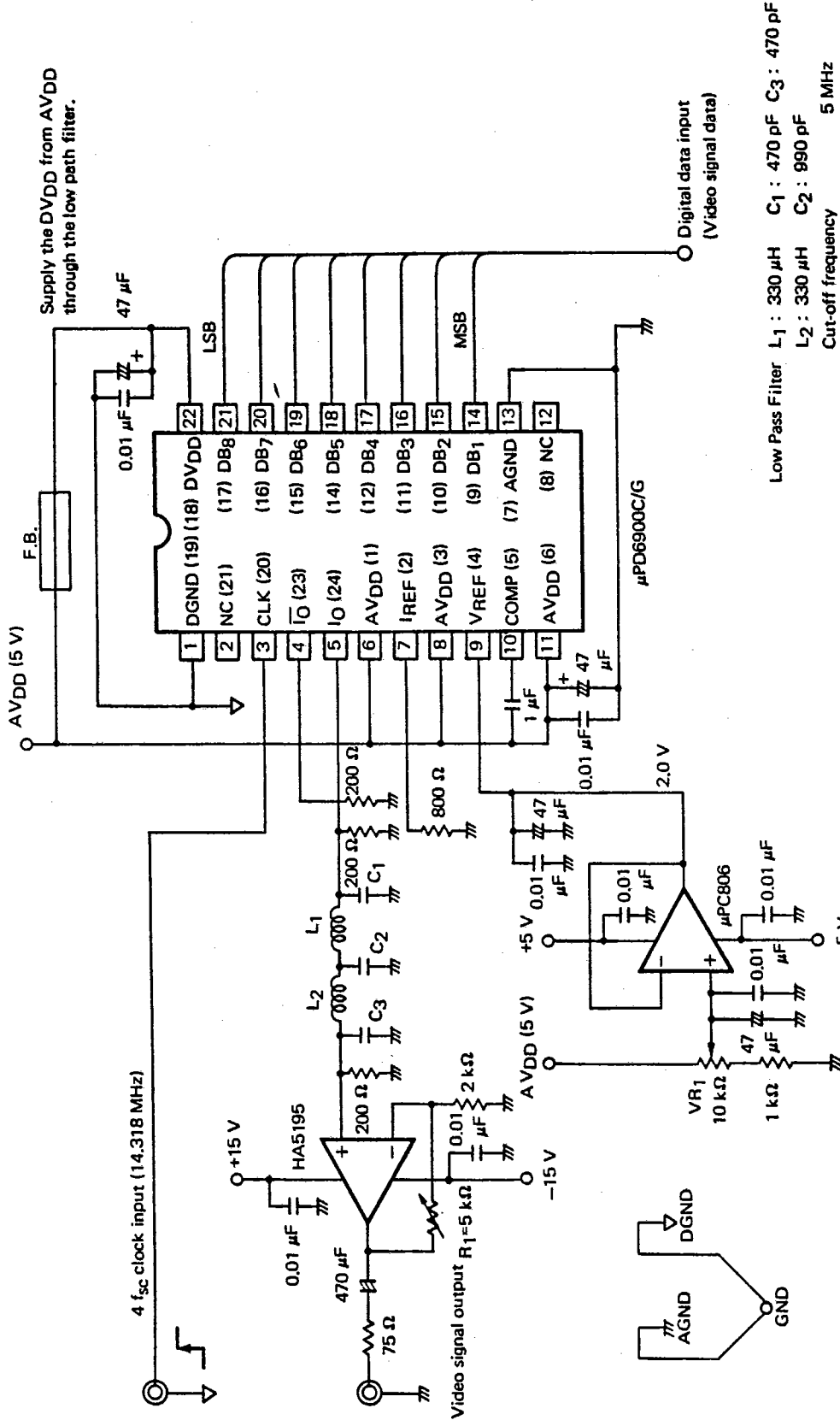
These pins may be connected to analog ground.

Example of an Application Circuit

This example shows D/A conversion of video signal (NTSC) digital data at a conversion rate of four times the subcarrier frequency ($4 f_{sc}$) to obtain the video output signal.

The analog output signal is passed via a low-pass filter (LPF) to a video amplifier (HA5195) to be amplified prior to output.

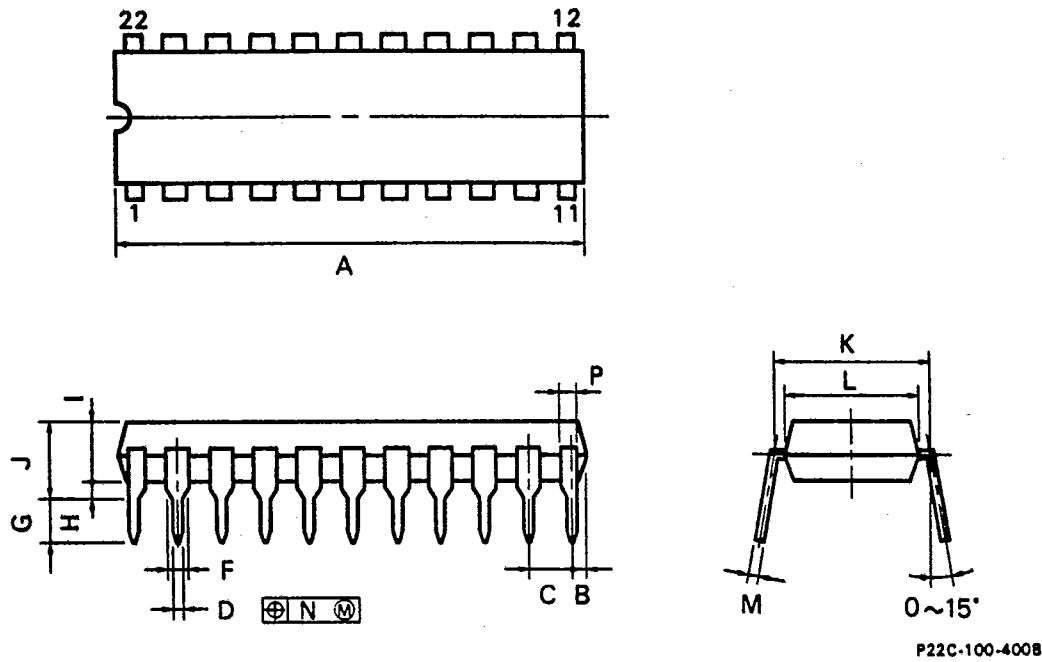
★ APPLICATION CIRCUIT



Low Pass Filter L₁ : 330 μH C₁ : 470 pF C₃ : 470 pF
L₂ : 330 μH C₂ : 990 pF
Cut-off frequency 5 MHz
Attenuation 30 dB/oct
Input/output impedance 200 Ω
F.B. : Ferrate Beads

() shows pins number of $\mu\text{PD6900G}$.
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NEC reserves the right to make changes at any time without notice in order to improve design and supply the best product possible.

22PIN PLASTIC DIP (400 mil)

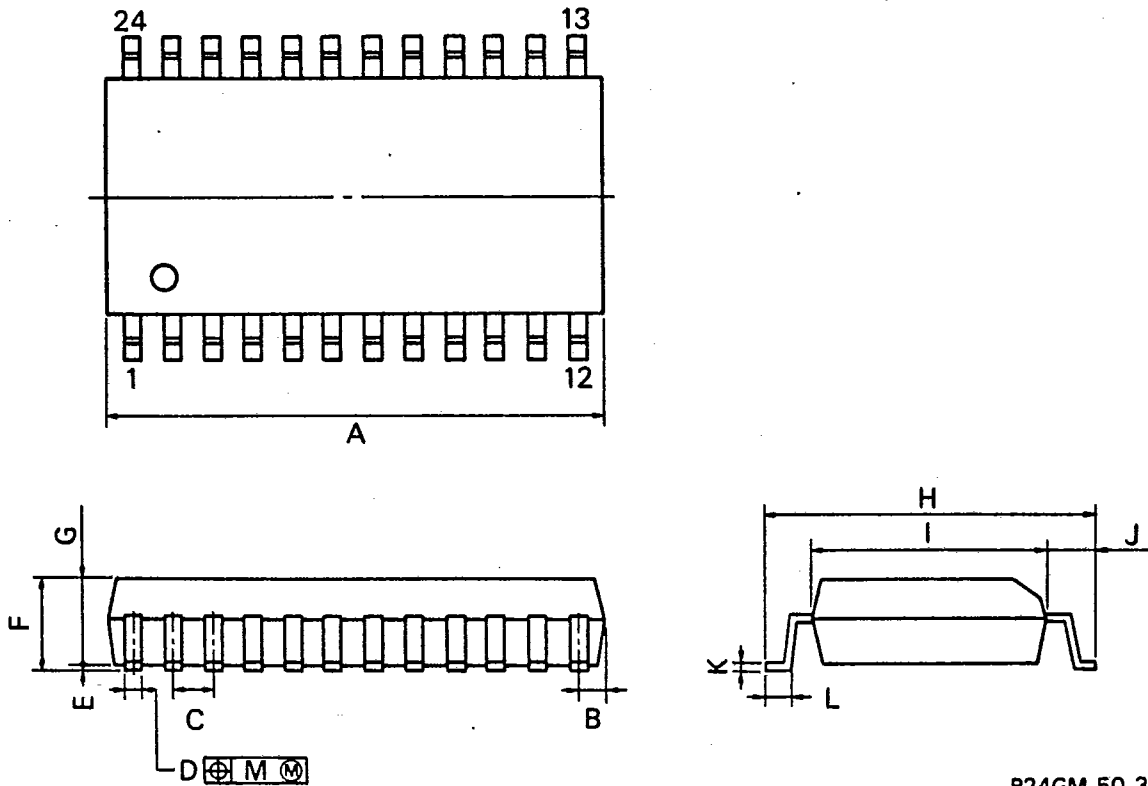


NOTES

- 1) Each lead centerline is located within 0.25 mm (0.01 inch) of its true position (T.P.) at maximum material condition.
- 2) Item "K" to center of leads when formed parallel.

ITEM	MILLIMETERS	INCHES
A	27.94 MAX.	1.100 MAX.
B	1.27 MAX.	0.050 MAX.
C	2.54 (T.P.)	0.100 (T.P.)
D	0.50 ^{+0.10}	0.020 ^{-0.004}
F	1.2 MIN.	0.047 MIN.
G	3.5 ^{+0.3}	0.138 ^{+0.012}
H	0.51 MIN.	0.020 MIN.
I	4.31 MAX.	0.170 MAX.
J	5.72 MAX.	0.226 MAX.
K	10.16 (T.P.)	0.400 (T.P.)
L	8.6	0.339
M	0.25 ^{-0.08}	0.010 ^{-0.003}
N	0.25	0.01
P	0.8 MIN.	0.031 MIN.

★ 24PIN PLASTIC SOP (375 mil)



P24GM-50-375B

NOTE

Each lead centerline is located within 0.12 mm (0.005 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	15.54 MAX.	0.612 MAX.
B	0.78 MAX.	0.031 MAX.
C	1.27 (T.P.)	0.050 (T.P.)
D	0.40 ^{+0.10} _{-0.08}	0.016 ^{+0.004} _{-0.003}
E	0.1 ^{±0.1}	0.004 ^{±0.004}
F	2.9 MAX.	0.115 MAX.
G	2.50	0.098
H	10.3 ^{±0.3}	0.406 ^{+0.013} _{-0.013}
I	7.2	0.283
J	1.6	0.063
K	0.15 ^{+0.10} _{-0.08}	0.006 ^{+0.004} _{-0.003}
L	0.8 ^{±0.2}	0.031 ^{+0.008} _{-0.008}
M	0.12	0.005

12