```
      bishow(2);
end;

procedure WritePort1;
begin
      write('dataA(BIN) = ');
      ReadData(1);
      AssignData(1);
      write('dataB(BIN) = ');
      ReadData(2);
      AssignData(2);
      port[$307] := $80;
      port[$304] := dataA;
      port[$306] := dataB;
end;

procedure ReadWritePort1;
begin
      port[$307] := $90;
      dataA := port[$304];
      transform(1);
      bishow(1);
      write('dataB(BIN) = ');
      ReadData(2);
      AssignData(2);
      port[$306] := dataB;
end;

procedure WriteReadPort1;
begin
      write('dataA(BIN) = ');
      ReadData(1);
      AssignData(1);
      port[$307] := $89;
      port[$304] := dataA;
```

```
        dataB := port[$306];
        transform(2);
        bishow(2);
end;

procedure ReadPort2;
begin
        port[$30B] := $9B;
        dataC := port[$308];
        transform(3);
        bishow(3);
        dataD := port[$30A];
        transform(4);
        bishow(4);
end;

procedure WritePort2;
begin
        write('dataC(BIN) = ');
        ReadData(3);
        AssignData(3);
        write('dataD(BIN) = ');
        ReadData(4);
        AssignData(4);
        port[$30B] := $82;
        port[$308] := dataC;
        port[$30A] := dataD;
end;

procedure ReadWritePort2;
begin
        port[$30B] := $92;
        dataC := port[$308];
        transform(3);
        bishow(3);
```

```
end;

begin {main}
 clrscr;
 selectshow(1);
 readln;
 selectshow(2);
 readln;
end.
```

```
        ctshow;
        delay (1000);
        writeln;
        write('press  Q  to quit');
        ch := readkey;
        until ch in ['Q','q'];
end.
```

ภาคผนวก ค

DATA IC

EXAR XR-2206

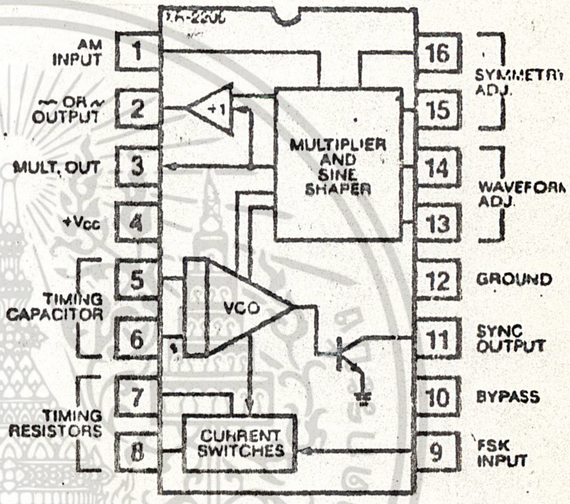
Monolithic Function Generator

GENERAL DESCRIPTION

The XR-2206 is a monolithic function generator integrated circuit capable of producing high quality sine, square, triangle, ramp, and pulse waveforms of high-stability and accuracy. The output waveforms can be both amplitude and frequency modulated by an external voltage. Frequency of operation can be selected externally over a range of 0.01 Hz to more than 1 MHz.

The circuit is ideally suited for communications, instrumentation, and function generator applications requiring sinusoidal tone, AM, FM, or FSK generation. It has a typical drift specification of 20 ppm/°C. The oscillator frequency can be linearly swept over a 2000:1 frequency range, with an external control voltage, having a very small affect on distortion.

FUNCTIONAL BLOCK DIAGRAM



FEATURES

Low-Sine Wave Distortion	0.5%, Typical
Excellent Temperature Stability	20 ppm/°C, Typical
Wide Sweep Range	2000:1, Typical
Low-Supply Sensitivity	0.01%V, Typical
Linear Amplitude Modulation	
TTL Compatible FSK Controls	
Wide Supply Range	10V to 26V
Adjustable Duty Cycle	1% to 99%

ORDERING INFORMATION

Part Number	Package	Operating Temperature
XR-2206M	Ceramic	−55°C to +125°C
XR-2206N	Ceramic	0°C to +70°C
XR-2206P	Plastic	0°C to +70°C
XR-2206CN	Ceramic	0°C to +70°C
XR-2206CP	Plastic	0°C to +70°C

APPLICATIONS

- Waveform Generation
- Sweep Generation
- AM/FM Generation
- V/F Conversion
- FSK Generation
- Phase-Locked Loops (VCO)

SYSTEM DESCRIPTION

The XR-2206 is comprised of four functional blocks; a voltage-controlled oscillator (VCO), an analog multiplier and sine-shaper; a unity gain buffer amplifier; and a set of current switches.

The VCO actually produces an output frequency proportional to an input current, which is produced by a resistor from the timing terminals to ground. The current switches route one of the timing pins current to the VCO controlled by an FSK input pin, to produce an output frequency. With two timing pins, two discrete output frequencies can be independently produced for FSK Generation Applications.

ABSOLUTE MAXIMUM RATINGS

Power Supply	26V
Power Dissipation	750 mW
Derate Above 25°C	5 mW/°C
Total Timing Current	6 mA
Storage Temperature	−65°C to +150°C

ELECTRICAL CHARACTERISTICS

Test Conditions: Test Circuit of Figure 1, $V^+ = 12V$, $T_A = 25°$, $C = 0.01\ \mu F$, $R_1 = 100\ k\Omega$, $R_2 = 10\ k\Omega$, $R_3 = 25\ k\Omega$ unless otherwise specified. S_1 open for triangle, closed for sine wave.

PARAMETERS	XR-2206M			XR-2206C			UNITS	CONDITIONS
	MIN	TYP	MAX	MIN	TYP	MAX		
GENERAL CHARACTERISTICS								
Single Supply Voltage	10		26	10		26	V	
Split-Supply Voltage	±5		±13	±5		±13	V	
Supply Current		12	17		14	20	mA	$R_1 \geq 10\ k\Omega$
OSCILLATOR SECTION								
Max. Operating Frequency	0.5	1		0.5	1		MHz	$C = 1000\ pF$, $R_1 = 1\ k\Omega$
Lowest Practical Frequency		0.01			0.01		Hz	$C = 50\ \mu F$, $R_1 = 2\ M\Omega$
Frequency Accuracy		±1	±4		±2		% of f_o	$f_o = 1/R_1C$
Temperature Stability		±10	±50		±20		ppm/°C	$0°C \leq T_A \leq 70°C$,
Supply Sensitivity		0.01	0.1		0.01		%/V	$R_1 = R_2 = 20\ k\Omega$ $V_{LOW} = 10V$, $V_{HIGH} = 20V$,
Sweep Range	1000:1	2000:1			2000:1		$f_H = f_L$	$R_1 = R_2 = 20\ k\Omega$ f_H @ $R_1 = 1\ k\Omega$ f_L @ $R_1 = 2\ M\Omega$
Sweep Linearity								
10:1 Sweep		2			2		%	$f_L = 1\ kHz$, $f_H = 10\ kHz$
1000:1 Sweep		8			8		%	$f_L = 100\ kHz$, $f_H = 100\ kHz$
FM Distortion		0.1			0.1		%	±10% Deviation
Recommended Timing Components								
Timing Capacitor: C	0.001		100	0.001		100	μF	See Figure 4.
Timing Resistors: R_1 & R_2	1		2000	1		2000	kΩ	
Triangle Sine Wave Output								See Note 1, Figure 2.
Triangle Amplitude		160			160		mV/kΩ	Figure 1, S_1 Open
Sine Wave Amplitude	40	60	80		60		mV/kΩ	Figure 1, S_1 Closed
Max. Output Swing		6			6		V p-p	
Output Impedance		600			600		Ω	
Triangle Linearity		1			1		%	
Amplitude Stability		0.5			0.5		dB	For 1000:1 Sweep
Sine Wave Amplitude Stability		4800			4800		ppm/°C	See Note 2.
Sine Wave Distortion								
Without Adjustment		2.5			2.5		%	$R_1 = 30\ k\Omega$
With Adjustment		0.4	1.0		0.5	1.5	%	See Figures 6 and 7.
Amplitude Modulation								
Input Impedance	50	100		50	100		kΩ	
Modulation Range		100			100		%	
Carrier Suppression		55			55		dB	
Linearity		2			2		%	For 95% modulation
Square-Wave Output								
Amplitude		12			12		V p-p	Measured at Pin 11.
Rise Time		250			250		nsec	$C_L = 10\ pF$
Fall Time		50			50		nsec	$C_L = 10\ pF$
Saturation Voltage		0.2	0.4		0.2	0.6	V	$I_L = 2\ mA$
Leakage Current		0.1	20		0.1	100	μA	$V_{11} = 26V$
FSK Keying Level (Pin 9)	0.8	1.4	2.4	0.8	1.4	2.4	V	See section on circuit controls
Reference Bypass Voltage	2.9	3.1	3.3	2.5	3	3.5	V	Measured at Pin 10.

Note 1: Output amplitude is directly proportional to the resistance, R_3, on Pin 3. See Figure 2.
Note 2: For maximum amplitude stability, R_3 should be a positive temperature coefficient resistor.

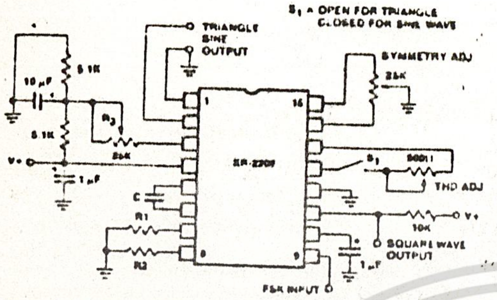


Figure 1. Basic Test Circuit.

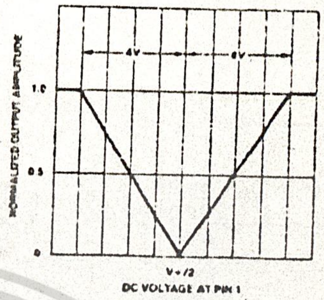


Figure 5. Normalized Output Amplitude versus DC Bias at AM Input (Pin 1).

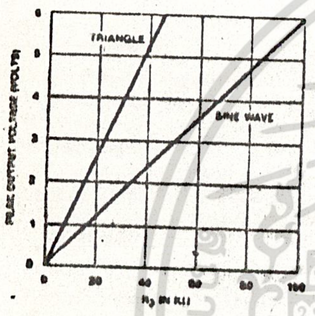


Figure 2. Output Amplitude as a Function of the Resistor, R_3, at Pin 3.

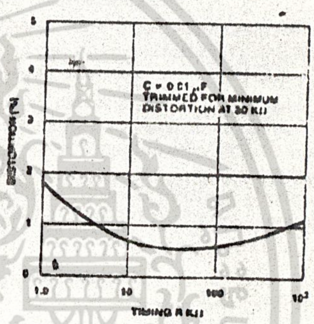


Figure 6. Trimmed Distortion versus Timing Resistor.

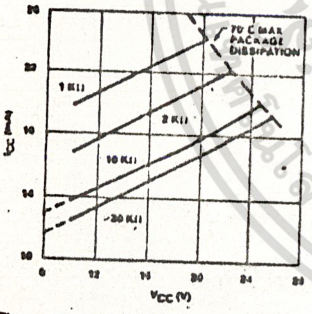


Figure 3. Supply Current versus Supply Voltage, Timing, R.

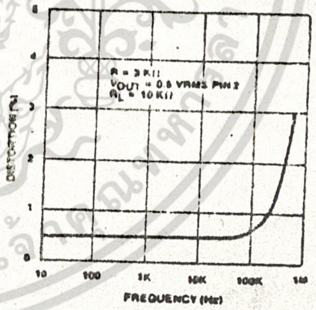


Figure 7. Sine Wave Distortion versus Operating Frequency with Timing Capacitors Varied.

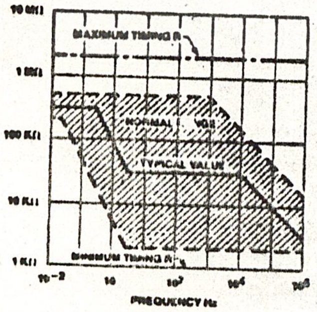


Figure 4. R versus Oscillation Frequency.

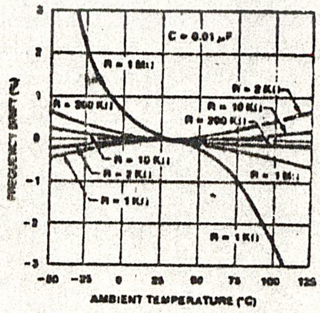


Figure 8. Frequency Drift versus Temperature.

PMI

PM-7541

CMOS 12-BIT MONOLITHIC MULTIPLYING D/A CONVERTER

Precision Monolithics Inc.

FEATURES

- Full Four-Quadrant Multiplication
- 12-Bit Endpoint Linearity (±1/2 LSB)
- Pretrimmed Gain
- TTL/CMOS Compatible
- Low Power Consumption
- Low Feedthrough Error
- Direct Replacement for AD7521 and AD7541
- Superior Power Supply Rejection from +5V to +15V
- Low Gain and Linearity Tempcos (TYP 2ppm of FSR/°C)
- Latch-Up Resistant

APPLICATIONS

- Digital/Synchro Conversion
- Programmable Amplifiers
- Ratiometric A/D Conversion
- Function Generator
- CRT Graphics Generator
- Digitally-Controlled Attenuator
- Digitally-Controlled Power Supplies
- Digital Filters

CROSS REFERENCE

PMI	ADI	TEMPERATURE RANGE
PM7541AX PM7541BX	AD7541TD AD7541SD	MILITARY
PM7541EX PM7541FX	AD7541BD AD7541AD	INDUSTRIAL
PM7541GP PM7541HP	AD7541KN AD7541JN	COMMERCIAL

GENERAL DESCRIPTION

The PMI PM-7541 is a 12-bit, 4-quadrant multiplying digital-to-analog converter. It is manufactured using an advanced oxide-isolated, silicon-gate, monolithic CMOS technology.

Laser-trimmed thin-film resistors on CMOS circuitry provide true 12-bit linearity and excellent absolute accuracy. The low power dissipation, together with NMOS temperature-compensating switches, assures the performance over the full temperature range. It is a pin-compatible replacement for Analog Devices AD7521 and AD7541 with equal or better performance.

ORDERING INFORMATION†

	PACKAGE: 18-PIN**		
NONLINEARITY	MILITARY* TEMPERATURE -55°C TO +125°C	INDUSTRIAL TEMPERATURE -25°C TO +85°C	COMMERCIAL TEMPERATURE 0°C TO +70°C
1 LSB	PM7541BX	PM7541FX	PM7541HP
1/2 LSB	PM7541AX	PM7541EX	PM7541GP

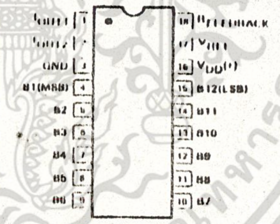
* For devices processed in total compliance to MIL-STD-883, add /883 after part number. Consult factory for 883 data sheet.

** (also available in Side Braze—XB)

† All commercial and industrial temperature range parts are available with burn-in. For ordering information see 1986 Data Book, Section 2.

** Package Designation:
Suffix X: Hermetic DIP (XB - Side Braze)
Suffix P: Epoxy DIP

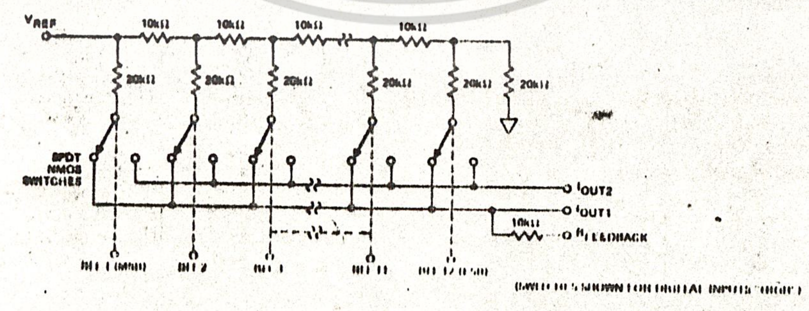
PIN CONNECTIONS



18-PIN EPOXY DIP
(P-Suffix)

18-PIN HERMETIC DIP
(X-Suffix)

FUNCTIONAL DIAGRAM



ABSOLUTE MAXIMUM RATINGS

(T_A = +25°C, unless otherwise noted.)

V_{DD} (to GND) .... +17V
V_{REF} (to GND) .... ±25V
Digital Input Voltage Range .... V_{DD} to GND
Output Voltage (Pin 1, Pin 2) .... 0.3V to V_{DD}
Power Dissipation (Package) 450mW
Derate Above +75°C .... 6mW/°C
Operating Temperature Range
AX/BX Versions .... −55°C to +125°C
EX/FX Versions .... −25°C to +85°C
GP/HP Versions .... 0°C to +70°C

Dice Junction Temperature .... +150°C
Storage Temperature .... −65°C to +150°C
Lead Temperature (Soldering, 60 sec) .... 300°C

CAUTION:

1. Do not apply voltages higher than V_{DD} or less than GND potential on any terminal except V_{REF} (Pin 17) and R_{FB} (Pin 18).
2. The digital control inputs are zener protected; however, permanent damage may occur on unprotected units from high-energy electrostatic fields. Keep units in conductive foam at all times until ready to use.
3. Use proper anti-static handling procedures.
4. Absolute Maximum Ratings apply to both packaged devices and DICE. Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device.

ELECTRICAL CHARACTERISTICS at V_{DD} = +15V, V_{REF} = +10V, AGND = DGND = 0V, V_{OUT1} = V_{OUT2} = 0V; and T_A = −55°C to +125°C apply for PM-7541AX/BX; T_A = −25°C to +85°C apply for PM-7541EX/FX; and T_A = 0°C to +70°C apply for PM-7541GP/HP, unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS	PM-7541A/E/G MIN	PM-7541A/E/G TYP	PM-7541A/E/G MAX	PM-7541B/F/H MIN	PM-7541B/F/H TYP	PM-7541B/F/H MAX	UNITS
STATIC ACCURACY									
Resolution	N		12	—	—	12	—	—	Bits
Nonlinearity (Notes 1, 2)	INL		—	—	±1/2	—	—	±1	LSB
Gain Error (Notes 3, 4)	G_{ER}	T_A = +25°C T_A = Full Temp. Range	— —	— —	±12.5 ±16.7	— —	— —	±12.5 ±16.7	LSB
Power Supply Rejection $\Delta Gain/\Delta V_{DD}$	PSRR	V_{DD} = +14.5V to +15.5V T_A = +25°C T_A = Full Temp. Range	— —	— —	±0.01 ±0.02	— —	— —	±0.01 ±0.02	%/%
Output Leakage Current (I_{OUT1}) (Notes 5, 6)	I_{LKG}	T_A = +25°C T_A = Full Temp. Range	— —	— —	±50 ±200	— —	— —	±50 ±200	nA
DYNAMIC PERFORMANCE									
Output Current Settling Time (Note 7)	t_S	To ±1/2 LSB of FSR	—	—	1.0	—	—	1.0	µs
Feedthrough Error (Note 7)		V_{REF} = 20V_{p-p} @ f = 10kHz All digital inputs low	—	—	1.0	—	—	1.0	mV p-p
REFERENCE INPUT									
Input Resistance (Note 8)	R_{REF}		5	—	20	5	—	20	kΩ
DIGITAL INPUTS									
Digital Input High	V_{IH}		2.4	—	—	2.4	—	—	V
Digital Input Low	V_{IL}		—	—	0.8	—	—	0.8	V
Input Leakage Current	I_{IL}	V_{IN} = 0 to 15V	—	—	±1	—	—	±1	µA
Input Capacitance (Note 7)	C_{IN}		—	—	10	—	—	10	pF
Input Coding		(Tables 1, 2)	Binary or Offset			Binary or Offset			

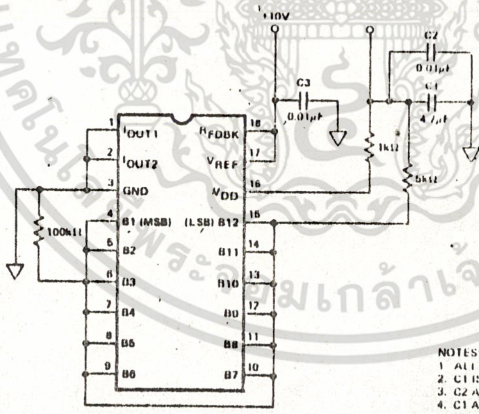
ELECTRICAL CHARACTERISTICS at V_{DD} = +15V, V_{REF} = +10V, AGND = DGND = 0V, V_{OUT1} = V_{OUT2} = 0V; and T_A = -55°C to +125°C apply for PM-7541AX/BX; T_A = -25°C to +85°C apply for PM-7541EX/FX; and T_A = 0°C to +70°C apply for PM-7541GP/HF, unless otherwise noted. (Continued)

			PM-7541A/E/G			PM-7541B/F/H			
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNITS
ANALOG OUTPUTS									
Output Capacitance (Note 7)	C_{OUT1}	Digital Inputs = V_{IH}	—	189	220	—	189	220	pF
	C_{OUT2}		—	36	60	—	36	60	
Output Capacitance (Note 7)	C_{OUT1}	Digital Inputs = V_{IL}	—	95	120	—	95	120	pF
	C_{OUT2}		—	134	165	—	134	165	
POWER SUPPLY									
V_{DD} Range	V_{DD}	Accuracy is not guaranteed over this range.	+5		+16	+5	—	+16	V
Supply Current	I_{DD}	Digital Inputs = V_{IH} or V_{IL}	—	—	2	—	—	2	mA

NOTES:

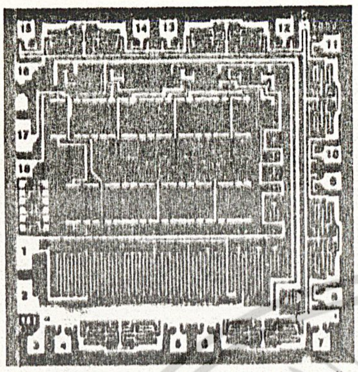
1. A/E/G versions are monotonic to 12-bits.
2. B/F/H versions are monotonic to 11-bits.
3. Using internal feedback resistor.
4. Maximum gain change from +25°C to T_{MAX} or T_{MIN} is ±4.2 LSB maximum.
5. Digital Inputs = V_{IL}.
6. Specification also applies for I_{OUT2} with all digital inputs = V_{IH}.
7. Guaranteed and not tested.
8. Absolute temperature coefficient is approximately +300 ppm/°C.

BURN-IN CIRCUIT



NOTES:
1. ALL RESISTORS ARE 1/4 WATT 5% TOLERANCE
2. C1 IS A 4.7µF ELECTROLYTIC CAPACITOR
3. C2 AND C3 ARE 0.01µF CERAMIC CAPACITORS
4. C1 AND C2 ONCE EVERY 10 DEVICES.

DICE CHARACTERISTICS



DIE SIZE 0.110 × 0.106 inch, 11,660 sq. mils
(2.692 × 2.794 mm, 7.52 sq. mm)

1. CURRENT OUTPUT 1
2. CURRENT OUTPUT 2
3. GROUND
4. DIGITAL INPUT (BIT 1) (MOST SIGNIFICANT BIT)
5. DIGITAL INPUT (BIT 2)
6. DIGITAL INPUT (BIT 3)
7. DIGITAL INPUT (BIT 4)
8. DIGITAL INPUT (BIT 5)
9. DIGITAL INPUT (BIT 6)
10. DIGITAL INPUT (BIT 7)
11. DIGITAL INPUT (BIT 8)
12. DIGITAL INPUT (BIT 9)
13. DIGITAL INPUT (BIT 10)
14. DIGITAL INPUT (BIT 11)
15. DIGITAL INPUT (BIT 12) (LEAST SIGNIFICANT BIT)
16. POSITIVE POWER SUPPLY
17. REFERENCE INPUT VOLTAGE
18. INTERNAL FEEDBACK RESISTOR

For additional DICE information refer to 1986 Data Book, Section 2.

WAFER TEST LIMITS at V_{DD} = +15V, V_{REF} = +10V, AGND = DGND = 0V, V_{OUT1} = V_{OUT2} = 0V, T_A = +25°C.

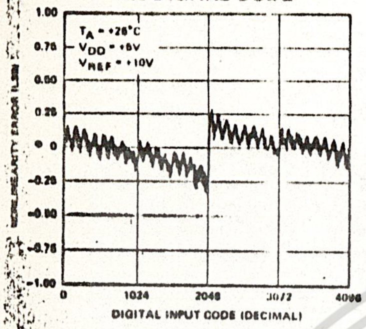
PARAMETER	SYMBOL	CONDITIONS	PM-7541G MIN	TYP	MAX	UNITS
STATIC ACCURACY						
Resolution	N		12	—	—	Bits
Nonlinearity	INL		—	—	±1	LSB
Gain Error (Note 1)	G_{ER}		—	—	±12.5	LSB
Power Supply Rejection	PSRR	V_{DD} = +14.5V to +15.5V	—	—	±0.01	%/%
Output Leakage Current (I_{OUT1}) (Note 2)	I_{LKG}	Digital Inputs = V_{IL}	—	—	±50	nA
REFERENCE INPUT						
Input Resistance	R_{REF}		5	—	20	kΩ
DIGITAL INPUTS						
Digital Input High	V_{IH}		2.4	—	—	V
Digital Input Low	V_{IL}		—	—	0.8	V
Input Leakage Current	I_{IL}	V_{IN} = 0 to 15V	—	—	±1	μA
POWER SUPPLY						
Supply Current	I_{DD}	Digital Inputs = V_{IH} or V_{IL}	—	—	2	mA

NOTES:
1. Using internal feedback resistor.
2. Specification also applies for I_{OUT2} but all Digital Inputs = V_{IH}.

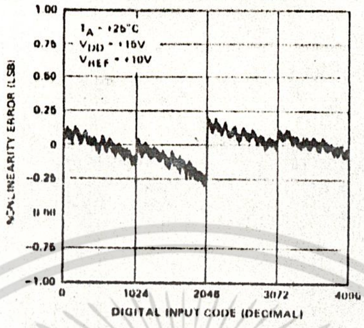
Electrical tests are performed at wafer probe to the limits shown. Due to variations in assembly methods and normal yield loss, yield after packaging is not guaranteed for standard product dice. Consult factory to negotiate specifications based on dice lot qualification through sample lot assembly and testing.

TYPICAL PERFORMANCE CHARACTERISTICS

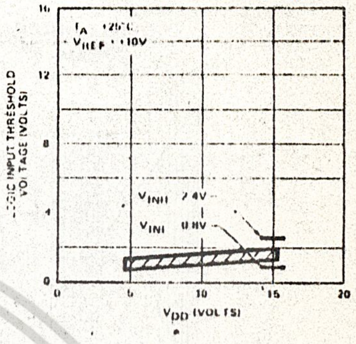
NONLINEARITY ERROR vs DIGITAL CODE



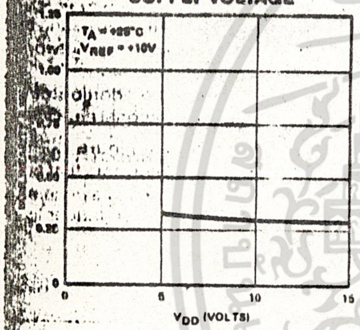
NONLINEARITY ERROR vs DIGITAL CODE



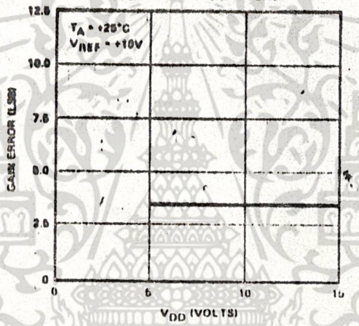
LOGIC INPUT THRESHOLD VOLTAGE vs SUPPLY VOLTAGE (V_{DD})



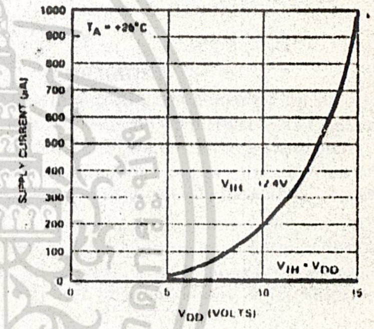
NONLINEARITY vs SUPPLY VOLTAGE



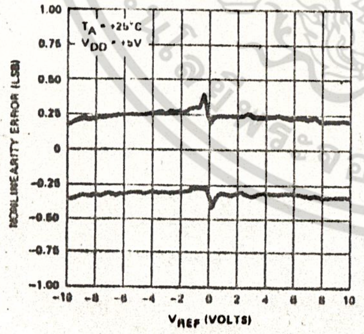
GAIN ERROR vs SUPPLY VOLTAGE



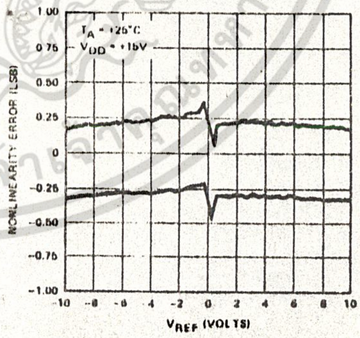
SUPPLY CURRENT vs SUPPLY VOLTAGE



NONLINEARITY ERROR vs REFERENCE VOLTAGE

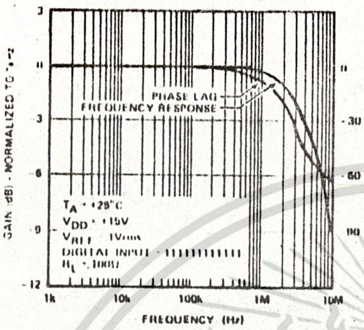


NONLINEARITY ERROR vs REFERENCE VOLTAGE

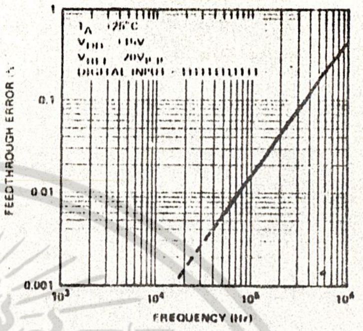


TYPICAL PERFORMANCE CHARACTERISTICS

V_{REF} PHASE LAG AND FREQUENCY RESPONSE



FEEDTHROUGH ERROR vs FREQUENCY



SPECIFICATION DEFINITIONS

RESOLUTION

The resolution of a DAC is the number of states (2^n) that the full-scale range (FSR) is divided (or resolved) into, where "n" is equal to the number of bits.

SETTLING TIME

Time required for the output function of the DAC to settle to within 1/2 LSB for a given digital input stimulus; i.e., zero to full scale.

GAIN

Ratio of the DAC's external-operational-amplifier output voltage to the V_{REF} input voltage.

FEEDTHROUGH ERROR

Error caused by capacitive coupling from V_{REF} to output with all switches OFF.

OUTPUT CAPACITANCE

Capacitance from I_{OUT1} or I_{OUT2} terminals to ground.

OUTPUT LEAKAGE CURRENT

Current which appears on I_{OUT1} terminal with all digital inputs LOW, or on I_{OUT2} terminal when all inputs are HIGH.

CIRCUIT DESCRIPTION

GENERAL CIRCUIT INFORMATION

The PM-7541 is a 12-bit multiplying D/A converter consisting of a highly-stable, silicon-chrome thin film R-2R ladder network and twelve pairs of NMOS current steering switches on a monolithic chip. Most applications require the addition of a voltage or current reference and an output operational amplifier.

A simplified circuit of the PM-7541 is shown in Figure 1. The R-2R inverted ladder binarily divides the input currents that are switched between I_{OUT1} and I_{OUT2} BUS lines. This switching allows a constant current to be maintained in each ladder leg independent of the input code.

FIGURE 1: SIMPLIFIED DAC CIRCUIT

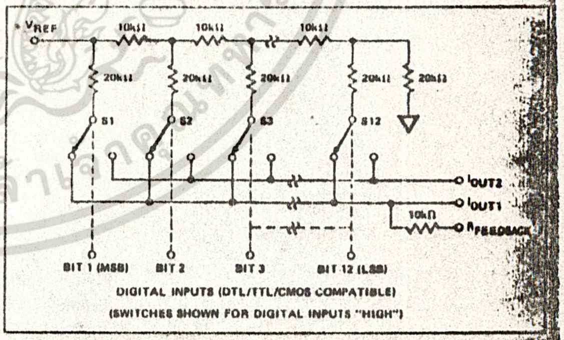
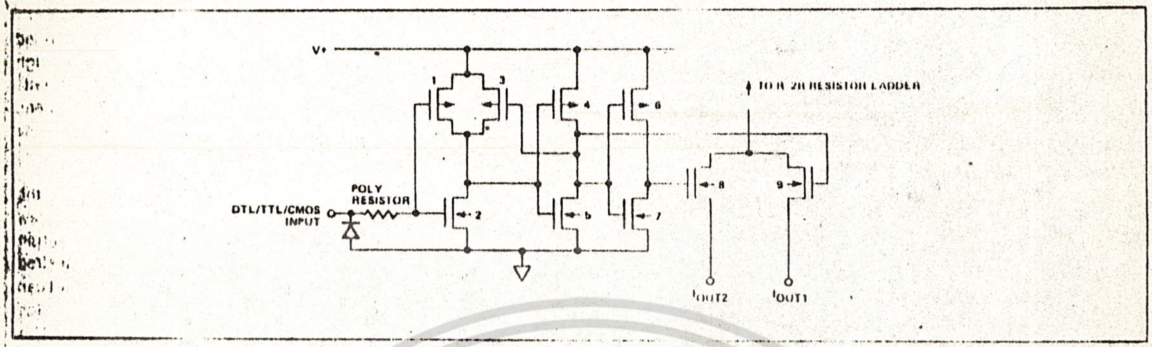


FIGURE 2: CMOS SWITCH



One of the twelve CMOS switches is shown in Figure 2. The digital input stage, devices 1, 2, and 3, drives the two inverters, devices 4, 5, 6, and 7; these inverters in turn drive the two output current steering switches, devices 8 and 9. Devices 1, 2, and 3 are designed such that the digital control inputs are DTL, TTL, and CMOS compatible over the full military temperature range.

The twelve output current-steering switches are in series with the R-2R resistor ladder, and therefore, can introduce bit errors. It is essential then, that the switch "ON" resistance be binarily scaled so that the voltage drop across each switch remains constant. If, for example, switch 1 of Figure 1 was designed with an "ON" resistance of 10 ohms, switch 2 for 20 ohms, etc., then with a 10 volt reference input, the current through switch 1 is 0.5mA, switch 2 is 0.25mA, etc., a constant 5mV drop will then be maintained across each switch.

EQUIVALENT CIRCUIT ANALYSIS

Figures 3 and 4 show the equivalent circuits for all digital inputs LOW and HIGH respectively. The reference current is switched to I_{OUT2} when all inputs are LOW and I_{OUT1} when inputs are HIGH. The $I_{LEAKAGE}$ current source is the combination of surface and junction leakages to the substrate; the 1/4096 current source represents the constant 1-bit current drain through the ladder terminating resistor. The output capacitance is dependent upon the digital input code, and is therefore modulated between the low and high values.

FIGURE 3: PM-7541 EQUIVALENT CIRCUIT (ALL INPUTS LOW)

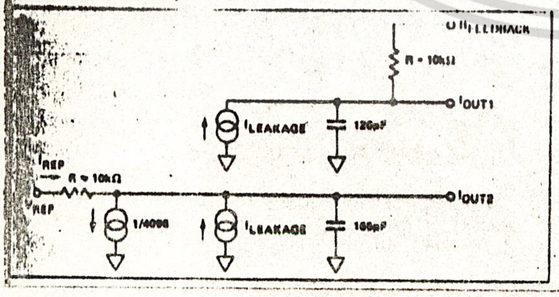
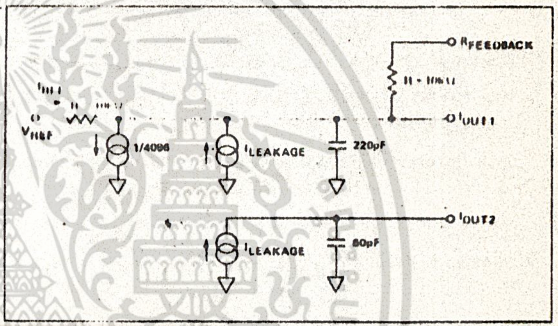


FIGURE 4: PM-7541 EQUIVALENT CIRCUIT (ALL DIGITAL INPUTS HIGH)



DYNAMIC PERFORMANCE

OUTPUT IMPEDANCE

The output resistance, as in the case of the output capacitance, is also modulated by the digital input code. The resistance looking back into the I_{OUT1} terminal, may be anywhere between 10kΩ (the feedback resistor alone when all digital inputs are low) and 7.5kΩ (the feedback resistor in parallel with approximately 30kΩ of the R-2R ladder network resistance when any single bit logic is high). The static accuracy and dynamic performance will be affected by this modulation. The gain and phase stability of the output amplifier, board layout, and power supply decoupling will all affect the dynamic performance of the PM-7541. The use of a compensation capacitor may be required when high-speed operational amplifiers are used. It may be connected across the amplifiers feedback resistor to provide the necessary phase compensation to critically damp the output.

The considerations when using high-speed amplifiers are:

1. Phase Compensation (See Figures 5 and 6).
2. Power supply decoupling at the device socket and use of proper grounding techniques.