

PCM52JG-V
PCM53JG-V
PCM53JG-I

DESIGNED FOR AUDIO

16-Bit Monolithic DIGITAL-TO-ANALOG CONVERTER

FEATURES

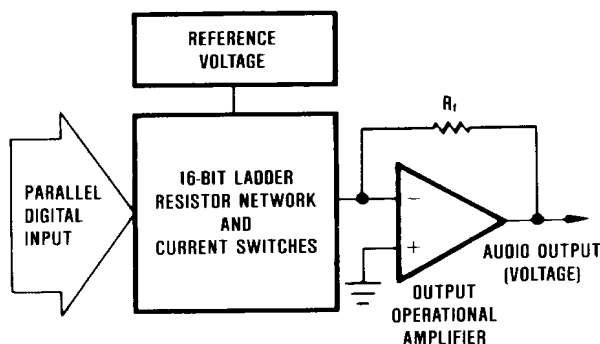
- **LOW COST**
- **NO EXTERNAL COMPONENTS REQUIRED**
- **16-BIT RESOLUTION**
- **16-BIT MONOTONICITY, typ**
- **0.001% OF FSR TYP DIFFERENTIAL LINEARITY ERROR**
- **0.002% THD (FS Input, 16 Bits), typ**
- **0.02% THD (-20dB, 16 Bits), typ**
- **3 μ sec SETTling TIME, typ**
- **96dB DYNAMIC RANGE**
- **$\pm 10V$ (PCM53) AND $\pm 5V$ (PCM52) AUDIO OUTPUT AVAILABLE**
- **EIAJ STC-007 COMPATIBLE**
- **INDUSTRY-STANDARD PINOUT**
- **COMPACT, 24-PIN DIP PACKAGE**

DESCRIPTION

The PCM52 and PCM53 are state-of-the-art, fully monolithic, digital-to-analog converters that are designed and specified for digital audio applications. These devices employ a segmented architecture and ultra-stable, nichrome (NiCr), thin-film, well-matched resistors to provide monotonicity, low distortion, and low differential linearity error (especially around bipolar zero) over long periods of time and over the full operating temperature range.

The PCM52-V and PCM53-V are completely self-contained with stable, low noise, internal, zener voltage reference; high speed current switches; resistor ladder network; and fast-settling, low noise, output operational amplifier all on a single monolithic chip. A special, open-loop reference circuit helps provide the fast settling time required for critical audio applications. The converters can be operated using two power supplies ($\pm 15V$) instead of three separate supplies. Few external components are necessary for operation, and all critical specifications are 100% tested. This helps to assure the user of high system reliability and outstanding overall system performance.

The PCM53JG-I is similar to the PCM53JG-V except it provides a current output that settles to within $\pm 0.006\%$ of FSR of its final value in typically 350nsec in response to a full-scale change in the digital input code.



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SPECIFICATIONS

ELECTRICAL

T_A = +25°C rated power supplies unless otherwise noted.

MODEL	PCM52/53			UNITS
	MIN	TYP	MAX	
INPUT				
DIGITAL INPUT				
Resolution		16		Bits
Dynamic Range		96		dB
Logic Levels (TTL/CMOS Compatible): Logic "1" at +40μA	+2.4		+V _{CC}	VDC
Logic "0" at -0.5mA	0		+0.8	VDC
TRANSFER CHARACTERISTICS				
ACCURACY				
Gain Error		±0.1	±1.0	%
Bipolar Zero Error ⁽¹⁾		±10	±50	mV
Differential Linearity Error at Bipolar Zero		0.001	0.005	% of FSR ⁽²⁾
Noise (rms)(20Hz to 20kHz) at Bipolar Zero: PCM52-V ⁽³⁾		15	30	μV
PCM53-V ⁽³⁾		30	60	μV
TOTAL HARMONIC DISTORTION⁽⁴⁾ (16-Bit Resolution)				
V _O = ±FS at f = 420Hz		0.002	0.004	%
V _O = -20dB at f = 420Hz		0.02	0.04	%
V _O = -60dB at f = 420Hz		1.9	4.0	%
MONOTONICITY				
		16		Bits
DRIFT (0°C to +70°C)				
Total Bipolar Drift (includes gain, offset, and linearity drift)		±25	±150	ppm of FSR/°C
		±0.1	±0.68	% of FSR
Bipolar Zero Drift		±0.01	±0.06	dB
		±4	±20	ppm of FSR/°C
SETTLING TIME (to ±0.006% of FSR)				
Voltage Models Output (PCM52-V, PCM53-V): 10V Step		3		μsec
1LSB Step		1		μsec
Current Model (PCM53-I) Output (1mA Step): 10Ω to 100Ω Load		350		nsec
1kΩ Load ⁽⁵⁾		350		nsec
Deglitcher Delay (THD Test) ⁽⁴⁾		2.5	4.0	μsec
Slew Rate		10		V/μsec
WARM-UP TIME				
	1			Min
OUTPUT				
ANALOG OUTPUT				
Voltage Models				
Ranges: PCM53-V	±9.8	±10	±10.2	V
PCM52-V	±4.9	±5	±5.1	V
Output Current	±5			mA
Output Impedance		0.1		Ω
Short-Circuit Duration		Indefinite to Common		
Current Model				
Range, PCM53-I (±30%)		±1		mA
Output Impedance (±30%)		2.4		kΩ
POWER SUPPLY				
SENSITIVITY				
+V _{CC}		±0.001		% of FSR/%V _{CC}
-V _{CC}		±0.001		% of FSR/%V _{CC}
V _{DD}		±0.001		% of FSR/%V _{CC}
POWER SUPPLY REQUIREMENTS				
Voltage: ±V _{CC}	±14.25	±15	±15.75	VDC
V _{DD}	+4.75	+5	+15.75	VDC
(V _{DD} may be connected to +V _{CC} supply voltage. Result is slightly increased total power dissipation of approximately 40mW).				
Supply Drain (no load): +V _{CC}		+18	+30	mA
-V _{CC}		-18	-30	mA
V _{DD}		+4	+10	mA
TEMPERATURE RANGE				
Specification	0		+70	°C
Operating	-25		+85	°C

NOTES: (1) Adjustable to zero with external potentiometer. (2) FSR means Full-Scale Range and is 20V for ±10V (PCM53-V) and 10V for ±5V range (PCM52-V). (3) Characterization units show at least two sigma units to meet this specification. Not 100% final tested. (4) The measurement of total harmonic distortion is highly dependent on the characteristics of the measurement circuit. Please contact factory for details. (5) Measured with an active clamp to provide a low impedance for approximately 200nsec.

DIGITAL INPUT AND ANALOG OUTPUT RELATIONSHIP

DIGITAL INPUT CODE	OUTPUT			
	Voltage Model		Current Model	
	16-Bit Resolution	14-Bit Resolution	16-Bit Resolution	14-Bit Resolution
Complementary Bipolar Offset Binary (COB) ±10V (PCM53): One LSB All Bits On 00...00 All Bits Off 11...11	+305μV +9.99969V -10.00000V	+1.22mV +9.99878V -10.00000V	0.031μA -0.99997mA -1.00000mA	0.122μA -0.99988mA +1.00000mA
±5V (PCM52): One LSB All Bits On 00...00 All Bits Off 11...11	+152μV +4.999848V -5.00000V	+610μV +4.99939V -5.00000V		

MECHANICAL

JG PACKAGE (TOP VIEW)

Pin numbers shown for reference only. Numbers may not be marked on package.

NOTE:
Leads in true position within .010" (.25mm) R at MMC at seating plane.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.185	1.263	30.10	32.08
B	.514	.600	13.06	15.24
C	.105	.200	2.67	5.08
D	.015	.021	0.38	0.53
F	.035	.070	0.89	1.78
G	100 BASIC		2.54 BASIC	
H	.030	.085	0.76	2.16
J	.008	.012	0.20	0.30
K	.120	.240	3.05	6.10
L	600 BASIC		15.24 BASIC	
M	15°		15°	
N	.025	.060	0.64	1.52

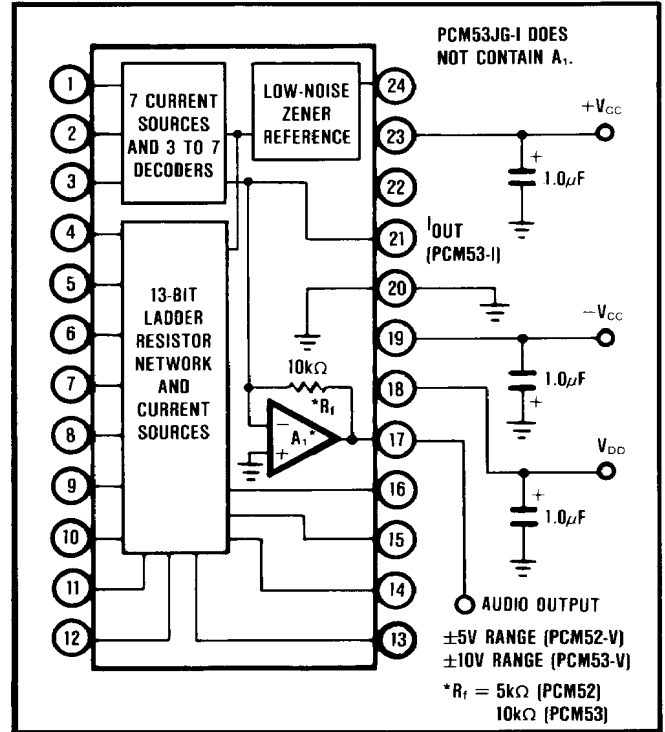
Actual package appearance may vary slightly from unit to unit. Pin spacing will not change.

ABSOLUTE MAXIMUM RATINGS

DC Supply Voltages	±18VDC
Input Logic Voltage	-1V to +Supply Voltage
Storage Temperature	-55°C to +100°C
Lead Temperature	
During Soldering	10sec at +300°C

The information in this publication has been carefully checked and is believed to be reliable; however, no responsibility is assumed for possible inaccuracies or omissions. Prices and specifications are subject to change without notice. No patent rights are granted to any of the circuits described herein.

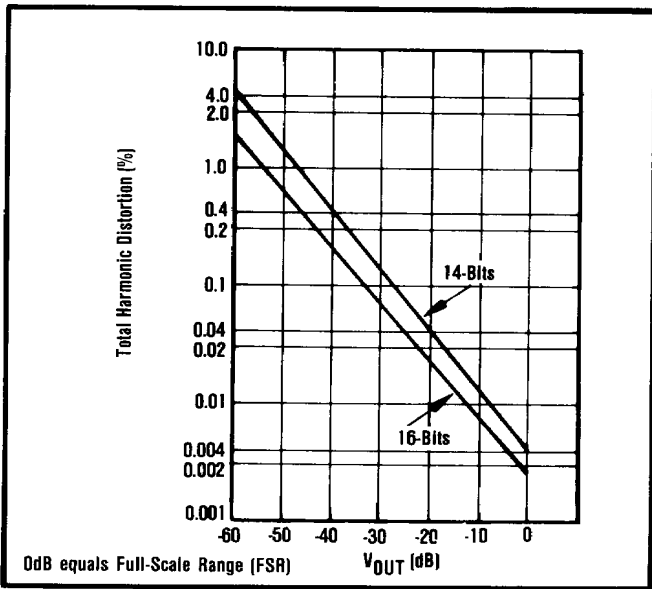
CONNECTION DIAGRAM



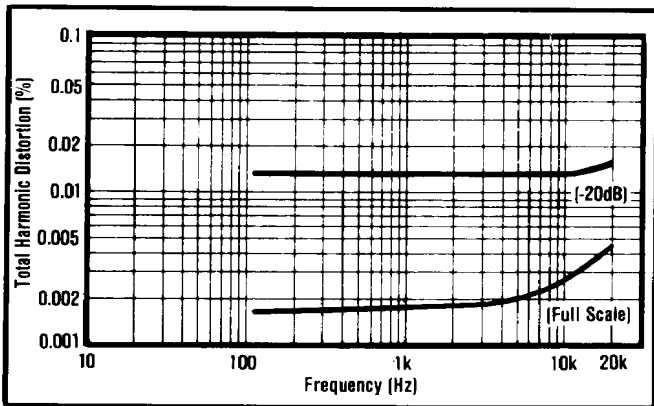
PIN ASSIGNMENTS

Pin No.	PCM52/53-V	PCM53-I
1	Bit 1 (MSB)	Bit 1 (MSB)
2	Bit 2	Bit 1
3	Bit 3	Bit 3
4	Bit 4	Bit 4
5	Bit 5	Bit 5
6	Bit 6	Bit 6
7	Bit 7	Bit 7
8	Bit 8	Bit 8
9	Bit 9	Bit 9
10	Bit 10	Bit 10
11	Bit 11	Bit 11
12	Bit 12	Bit 12
13	Bit 13	Bit 13
14	Bit 14	Bit 14
15	Bit 15	Bit 15
16	Bit 16 (LSB)	Bit 16 (LSB)
17	±5V Audio Out (PCM52-V) ±10V Audio Out (PCM53-V)	R _f (10kΩ ±30%)
18	V _{DD}	V _{DD}
19	-V _{CC}	-V _{CC}
20	Common	Common
21	Summing Junction	I _{OUT} , ±1mA ±30% (Audio Output)
22	Test Point	Test Point
23	+V _{CC}	+V _{CC}
24	Reference Out (+6.3V)	Reference Out (+6.3V)

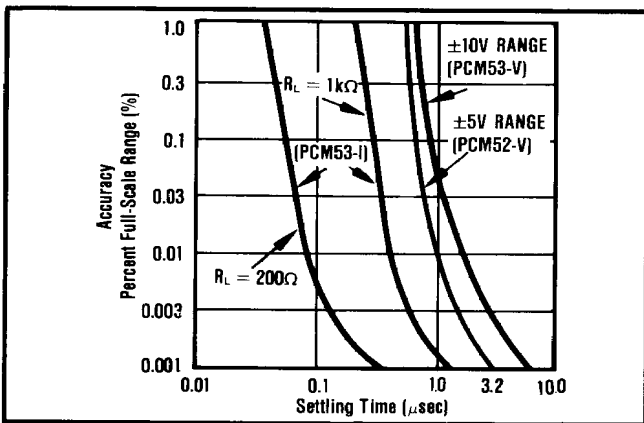
TYPICAL PERFORMANCE CURVES



Total Harmonic Distortion (THD) vs V_{OUT} .

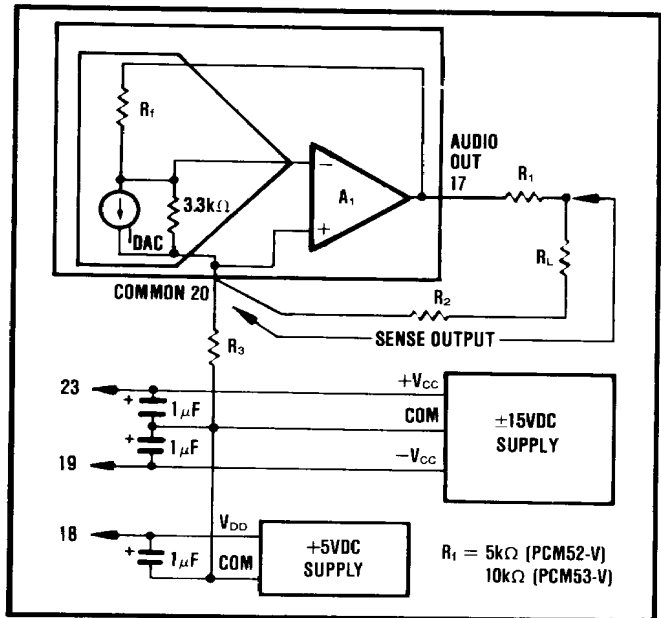


Total Harmonic Distortion (THD) vs Frequency.

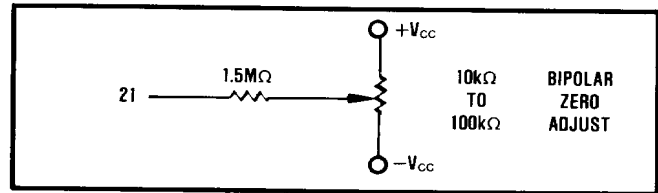


Full-Scale Range Settling Time vs Accuracy.

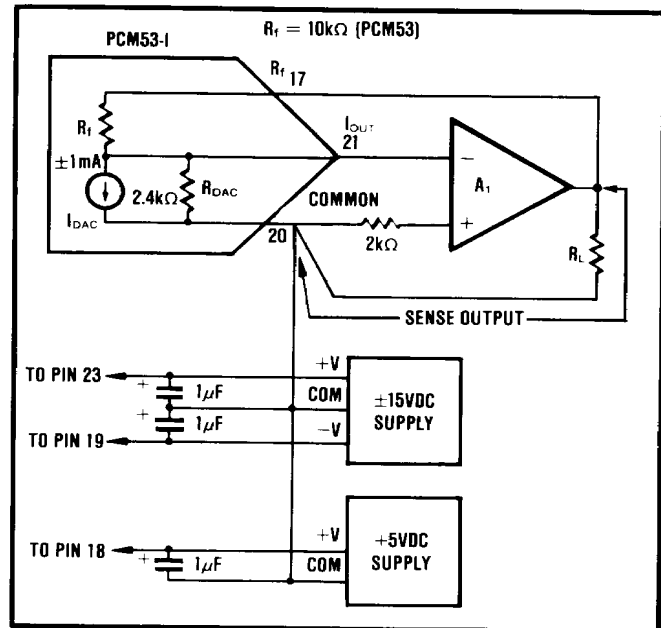
APPLICATION DIAGRAMS



Output Circuit for PCM52/53-V.



Optional External Bipolar Zero Adjust.



Preferred External Op Amp Configuration Using PCM53-I.