DESCRIPTION

The 5007/5008 series of 8-bit monolithic multiplying Digital-to-Analog Converters provide very high speed performance coupled with low cost and outstanding applications flexibility.

Advanced circuit design achieves 85ns settling times with very low glitch and at low power consumption. Monotonic multiplying performance is attained over a wide 40 to 1 reference current range. Matching to within 1 LSB between reference and full scale currents eliminates the need for full scale trimming in most applications. Direct interface to all popular logic families with full noise immunity is provided by the high swing, adjustable threshold logic inputs.

Dual complementary outputs are provided, increasing versatility and enabling differential operation to effectively double the peak-to-peak output swing. True high voltage compliance outputs allow direct output voltage conversion and eliminate output op amps in many applications.

All 5007/5008 series models guarantee full 8-bit monotonicity and linearities as tight as 0.1% over the entire operating temperature range are available. Device performance is essentially unchanged over the ±4.5V to ±18V power supply range, with 33mW power consumption attainable at ±5V supplies.

The compact size and low power consumption make the 5007/5008 attractive for portable and military/aerospace applications.

FEATURES

- **Fast settling output current—85ns**
- **Full scale current prematched to ±1 LSB**
- **Direct interface to TTL, CMOS, ECL, HTL, PMOS**
- **Relative accuracy to 0.1% maximum over temperature range**
- **High output compliance—-10V to +18V**
- **True and complemented outputs**
- **Wide range multiplying capability**
- **Low FS current drift—±10ppm/°C**
- **Wide power supply range—±4.5V to ±18V**
- **Low power consumption—33mW at ±5V**
- **SE5008 military qualifications pending**

APPLICATIONS

- **8-bit, 1μs A-to-D converters**
- **Servo-motor and pen drivers**
- **Waveform generators**
- **Audio encoders and attenuators**
- **Analog meter drivers**
- **Programmable power supplies**
- **CRT display drivers**
- **High speed modems**
- **Other applications where low cost, high speed and complete input/output versatility are required**

ORDERING INFORMATION

RELATIVE ACCURACY	0 to 70°C	-55 to 125°C
0.39% FS	NE5007N NE5007F	-
0.19% FS	NE5008N NE5008F	SE5008F

DEFINITION OF TERMS

Accuracy—The maximum deviation of the Dac output relative to an ideal straight line drawn from zero to full scale: 1 LSB for any bit combination

Differential linearity—The incremental error from an ideal 1 LSB analog output change when the digital input is changed 1 LSB; guaranteed monotonicity requires the differential linearity error be less than 1 LSB and with a tempco of essentially zero

Full scale tempco—The change in Dac full scale current with change in temperature expressed in ppm/°C

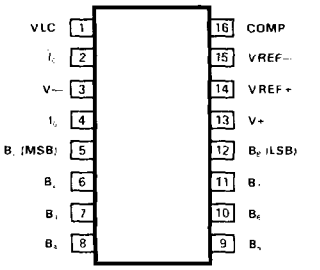
Monotonicity—For a 1 LSB increase of input code, the output either increases or remains the same

Output voltage compliance—The range of allowable voltage levels the output pins can assume without a major effect on circuit performance

Power supply sensitivity—The change in Dac output current with changes in power supply voltage

PIN CONFIGURATION

F,N PACKAGE*



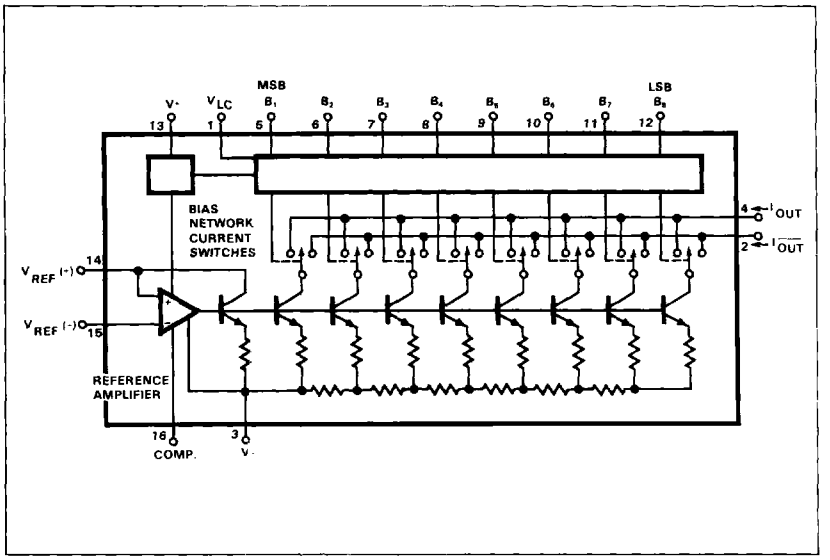
*N = Plastic DIP
F = Cerdip

CROSS REFERENCE

The 5007/5008 series are pin and functionally compatible with the monoDAC-08 series of devices.

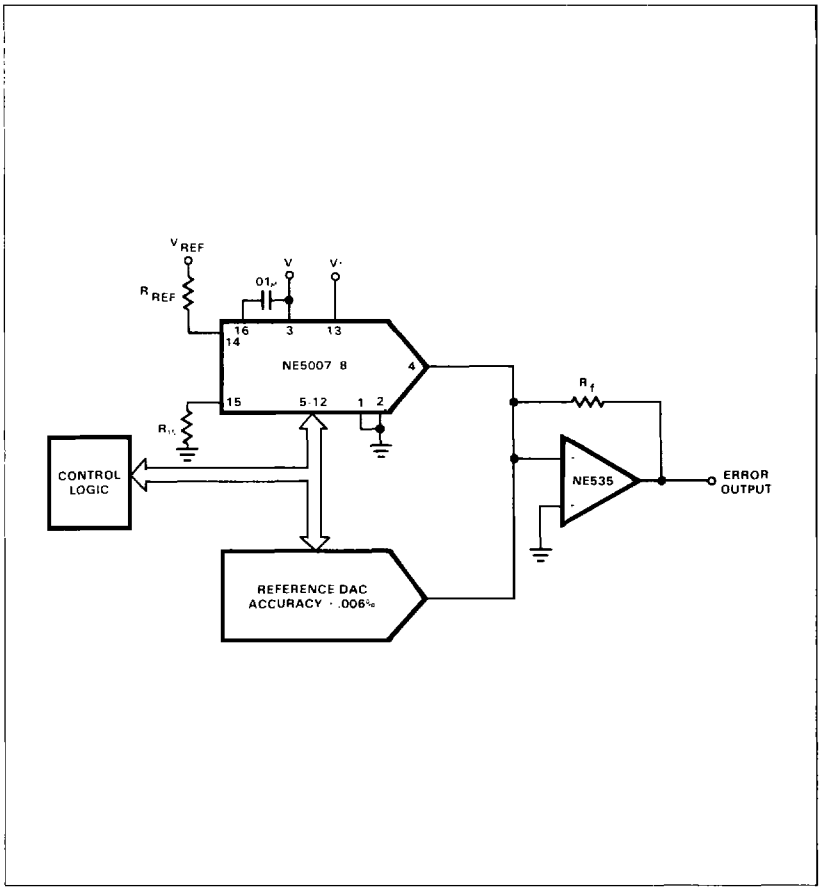
PMI	SIGNETICS
monoDAC-08A	SE5009
monoDAC-08	SE5008
monoDAC-08E	NE5008
monoDAC-08C	NE5007

BLOCK DIAGRAM



II

TEST CIRCUIT



ABSOLUTE MAXIMUM RATINGS T_A = 25°C unless otherwise noted

PARAMETER		RATING	UNIT
T_A	Operating temperature range		°C
	SE5008	-55 to +125	
	NE5007/8	0 to +70	
t_{stg}	Storage temperature	-65 to +150	°C
P_D	Power dissipation	500	mW
	Lead soldering temperature (60sec)	300	°C
	V+ to V- supply	36	V
	Logic inputs	V- to V- plus 36V	
V_{LC}	Logic threshold control	V- to V+	
	Analog current outputs	See output current or output voltage performance curve	
V_{14}, V_{15}	Reference inputs	V- to V+	
V_{14} to V_{15}	Reference input differential voltage	±18	V
I_{14}	Reference input current	5.0	mA

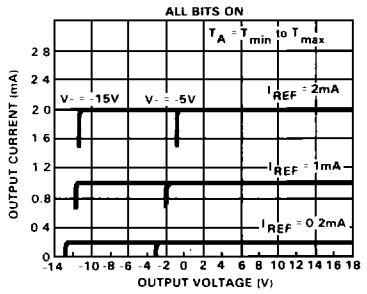
AC ELECTRICAL CHARACTERISTICS V_S = ±15V, I_{REF} = 2.0mA, Output characteristics refer to both IOUT and $\overline{IOUT}$ unless otherwise noted. NE5008: T_A = 0°C to 70°C. SE5008: T_A = -55°C to 125°C.

PARAMETER		TEST CONDITIONS	NE5007			NE5008			SE5008[1]			UNIT
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
	Resolution		8	8	8	8	8	8	8	8	8	Bits
	Monotonicity		8	8	8	8	8	8	8	8	8	Bits
	Relative accuracy	Over temperature range			±0.39			±0.19			±0.19	%FS
t_s	Settling time	To ±½ LSB, all bits switched on or off, T_A=25°C		100			100			100		ns
t_{PLH} t_{PHL}	Propagation delay Low-to-high High-to-low	T_A=25°C, each bit. All bits switched		35			35			35	60	ns
TCI_{FS}	Full scale tempco			±10			±10			±10		ppm/°C
V_{OC}	Output voltage compliance	Full scale current change <½ LSB	-10		+18	-10		+18	-10		+18	V
I_{FS4}	Full scale current	V_{REF}=10.000V, R_{14}, R_{15}=5.000kΩ, T_A=25°C	1.94	1.99	2.04	1.94	1.99	2.04	1.94	1.99	2.04	mA
I_{FSS}	Full scale symmetry	I_{FS4}-I_{FS2}		±2.0	±16		±1.0	±8.0		±1.0	±8.0	μA
I_{ZS}	Zero scale current			0.2	4.0		0.2	2.0		0.2	2.0	μA
I_{FSR}	Output current	V-=-5.0V V-=-7.0V to -18V	0 0	2.0 2.0	2.1 4.2	0 0	2.0 2.0	2.1 4.2	0 0	2.0 2.0	2.1 4.2	mA
V_{IL} V_{IH}	Logic input levels Low High	V_{LC}=0V	 2.0		0.8	 2.0		0.8	 2.0		0.8	V
I_{IL} I_{IH}	Logic input current Low High	V_{LC}=0V V_{IN}=-10V to +0.8V V_{IN}=2.0V to 18V		-2.0 0.002	-10 10		-2.0 0.002	-10 10		-2.0 0.002	-10 10	μA
V_{IS}	Logic input swing	V-=-15V	-10		+18	-10		+18	-10		+18	V
V_{THR}	Logic threshold range	V_S=±15V	-10		+13.5	-10		+13.5	-10		+13.5	V
I_{15}	Reference bias current			-1.0	-3.0		-1.0	-3.0		-1.0	-3.0	μA
dI/dt	Reference input slew rate	Figures 1, 3		8.0			8.0			8.0		mA/μs
$PSSI_{FS+}$ $PSSI_{FS-}$	Power supply sensitivity Positive Negative	I_{REF}=1mA V+=4.5 to 5.5V, V-=-15V; V+=13.5 to 16.5V, V-=-15V V-=-4.5 to -5.5V, V+=+15V; V-=-13.5 to -16.5, V+=+15V		0.0003 0.002	0.01 0.01		0.0003 0.002	0.01 0.01		0.0003 0.002	0.01 0.01	%FS/%VS
I+ I-	Power supply current Positive Negative	V_S=±5V, IREF=1.0mA		2.3 -4.3	3.8 -5.8		2.3 -4.3	3.8 -5.8		2.3 -4.3	3.8 -5.8	mA
I+ I-	Positive Negative	V_S=+5V, -15V, I_{REF}=2.0mA		2.4 -6.4	3.8 -7.8		2.4 -6.4	3.8 -7.8		2.4 -6.4	3.8 -7.8	
I+ I-	Positive Negative	V_S=±15V, I_{REF}=2.0mA		2.5 -6.5	3.8 -7.8		2.5 -6.5	3.8 -7.8		2.5 -6.5	3.8 -7.8	
P_D	Power dissipation	±5V, I_{REF}=1.0mA +5V, -15V, I_{REF}=2.0mA ±15V, I_{REF}=2.0mA		33 108 135	48 136 174		33 108 135	48 136 174		33 108 135	48 136 174	mW

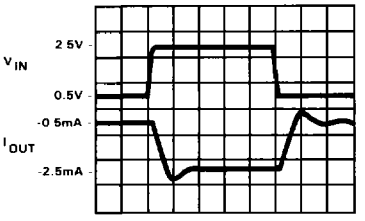
II

TYPICAL PERFORMANCE CHARACTERISTICS

OUTPUT CURRENT vs OUTPUT VOLTAGE (OUTPUT VOLTAGE COMPLIANCE)

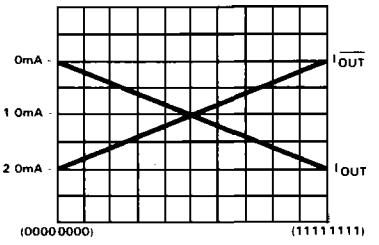


FAST PULSED REFERENCE OPERATION

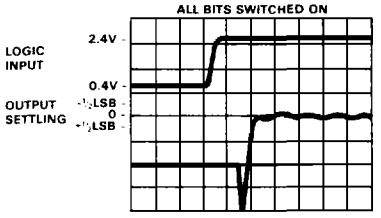


200ns/division
See Figure 1
R_{EQ} = 200Ω R_L = 100Ω CC = 0

TRUE AND COMPLEMENTARY OUTPUT OPERATION



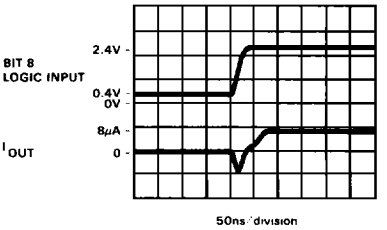
FULL SCALE SETTLING TIME



50ns/division

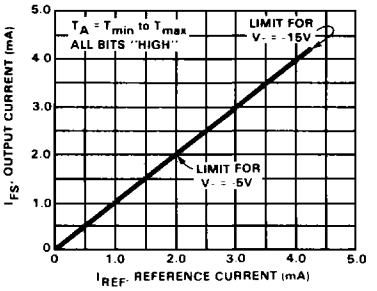
See Figure 8 of application memo for settling time fixture
IFS = 2mA, R_L = 1KΩ, LSB = 4μA

LSB SWITCHING

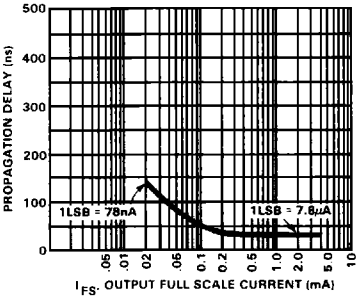


50ns/division

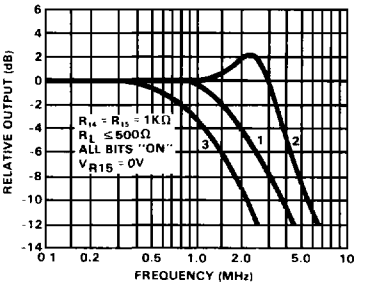
FULL SCALE CURRENT vs REFERENCE CURRENT



LSB PROPAGATION DELAY vs IFS



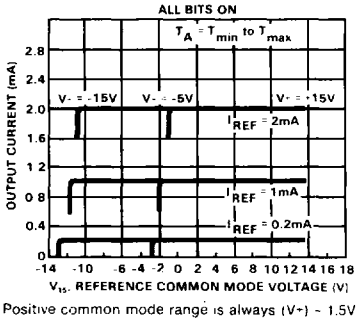
REFERENCE INPUT FREQUENCY RESPONSE



Curve 1: CC = 15pF, V_{IN} = 2.0V p-p centered at -1.0V.
Curve 2 CC = 15pF V_{IN} = 50mV p-p centered at +200mV
Curve 3 CC = 0pF, V_{IN} = 100mV p-p centered at 0V and applied thru 50Ω connected to pin 14 -2.0V applied to R_{14}.

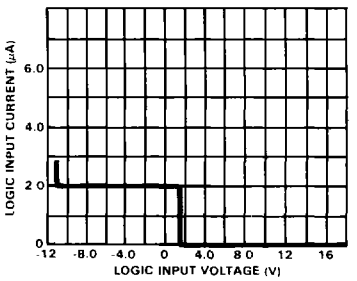
TYPICAL PERFORMANCE CHARACTERISTICS (Cont'd)

REFERENCE AMP COMMON MODE RANGE

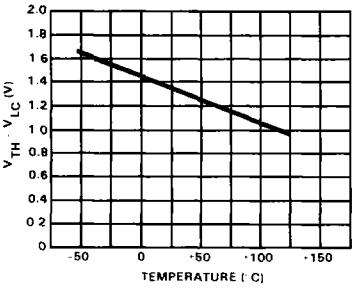


Positive common mode range is always (V+) - 1.5V

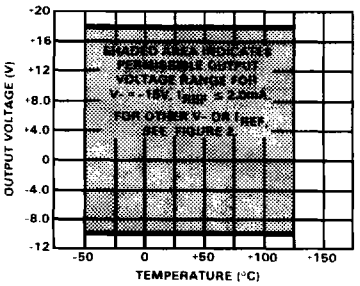
LOGIC INPUT CURRENT vs INPUT VOLTAGE



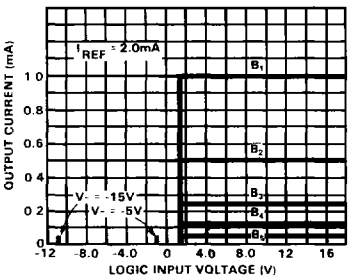
$V_{TH} - V_{LC}$ vs TEMPERATURE



OUTPUT VOLTAGE COMPLIANCE vs TEMPERATURE



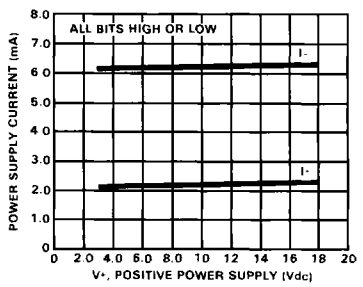
BIT TRANSFER CHARACTERISTICS



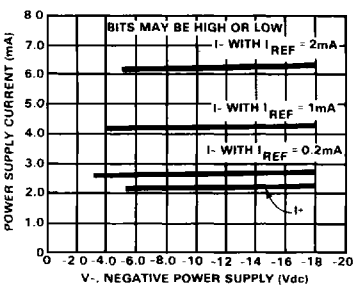
NOTE

B_1 through B_8 have identical transfer characteristics Bits are fully switched, with less than ½ LSB error at less than ±100mV from actual threshold. These switching points are guaranteed to lie between 0.8 and 2.0 volts over the operating temperature range (VLC = 0.0V).

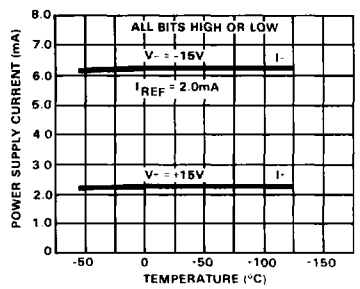
POWER SUPPLY CURRENT vs V+



POWER SUPPLY CURRENT vs V-

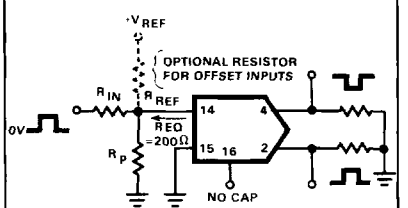


POWER SUPPLY CURRENT vs TEMPERATURE



TYPICAL APPLICATION

PULSED REFERENCE OPERATION



TYPICAL VALUES

R_{IN} = 5K

+V_{IN} = 10V