BA9221
BA9221F

Digital-to-analog converter, 12 bit

The BA9221 and BA9221F are 12-bit D/A converters.

These ICs have a very fast conversion time. They are for use on machines with a digital-to-analog control system.

Features

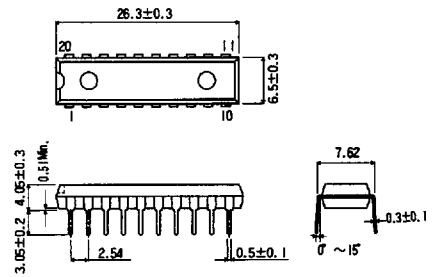
- available in DIP20 and SOP22 packages
- 12–bit monotonic conversion
- full scale current (I_{FS}) = 4 mA
- setting speed is as low as 250 ns
- built in reference supply voltage
- can be as multipliers

Applications

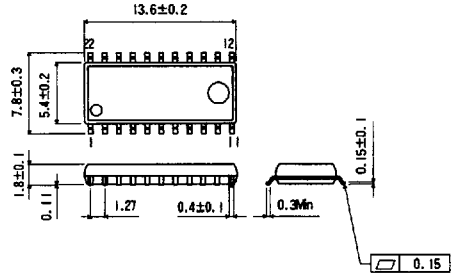
- digital audio equipment
- digital control attenuators
- electrical musical instruments
- servo controllers
- digitally controlled power supply

Dimensions (Units : mm)

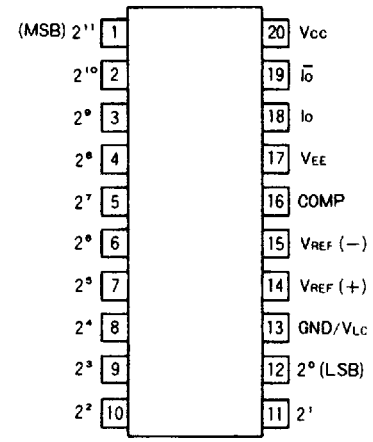
BA9221 (DIP20)



BA9221F (SOP22)



Pin connections



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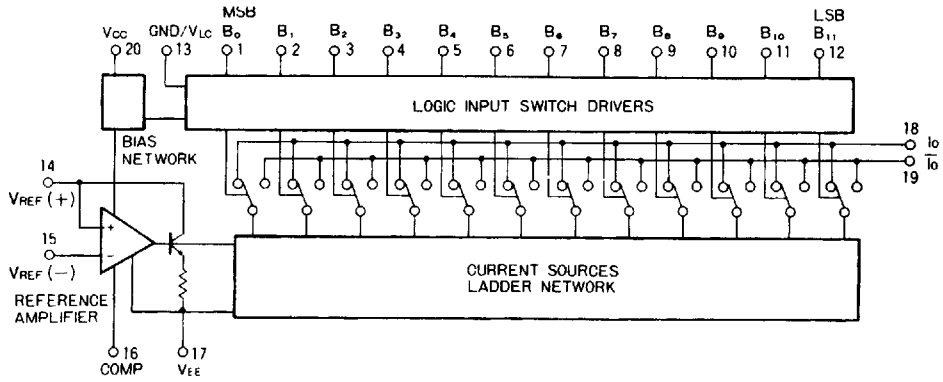
Block diagram



Absolute maximum ratings (T_a = 25°C)

Parameter		Symbol	Limits	Unit	Conditions
Power supply voltage		V_{CC}	+7	V	
		V_{EE}	−18		
Power dissipation	BA9221	P_d	600	mV	Reduce power by 6 mW/°C for each degree above 25°C.
	BA9221F		550		Reduce power by 5.5 mW/°C for each degree above 25°C.
Reference input pin V_{14}, V_{15}		V_{14}, V_{15}	V_{EE} ~ V_{CC}	V	
Logic input pin		V_{IN}	−5 ~ V_{CC}	V	
Operating temperature	BA9221	T_{opr}	−25 ~ +70	°C	
	BA9221F		−25 ~ +55		
Storage temperature		T_{stg}	−50 ~ +125	°C	

Code formats

Data input	Analog output
MSB LSB	**V_O (V)**
0 1 1 1 1 1 1 1 1 1 1 1	9.9951
0 1 1 1 1 1 1 1 1 1 1 0	9.9902
0 0 0 0 0 0 0 0 0 0 0 1	0.0049
0 0 0 0 0 0 0 0 0 0 0 0	0.0000
1 1 1 1 1 1 1 1 1 1 1 1	−0.0049
1 0 0 0 0 0 0 0 0 0 0 1	−9.9951
1 0 0 0 0 0 0 0 0 0 0 0	−10.0000

Electrical characteristics (T_a = 25°C, V_{CC} = +5 V, V_{EE} = -15 V)

Parameter	Symbol	Min	Typical	Max	Unit	Conditions	Test figure
Resolving power		12	12	12	bit		1
Monotonality		12	12	12	bit		1
Differential nonlinearity	DNL	12			LSB		1
Nonlinearity	NL			0.05	%FS		1
Full scale current	I_{FS}		3.999		mA	V_{REF} = 10.000 V	1
Current temperature coefficient, full scale	TCI_{FS}		±10		ppm/°C		1
Current asymmetry, full scale	I_{FSS}			±2.0	μA	$I_{FS} - \overline{I_{FS}}$	1
Current, zero scale	I_{ZS}			0.1	μA		1
Setting time	t_S		250		ns	T_a = 25°C	3
High level logic input voltage	V_{IH}	2.0			V		6
Low level logic input voltage	V_{IL}			0.8	V		6
Logic input current	I_{IN}			60	μA	V_{IN} = 5 V ~ +5 V	6
Reference power supply input current	I_{REF}	0.2	1.0	1.1	mA		2
Reference power supply input bias current	I_{15}		–0.5	–2.0	μA		1
Reference power supply input slew rate	dI/dt	4.0	8.0		mA/μs	R_{14} = 800 Ω, V_{CC} = 0 pF	4
Power supply voltage dependance	PSS+			±0.0001	%FS/%	V_{EE} = 4.5 V ~ 5.5 V, V_{CC} = –15 V	1
	PSS–			±0.0001	%FS/%	V_{EE} = 13.5 V ~ –16.5 V, V_{CC} = 5 V	1
Power supply voltage	V_{CC}	4.5		5.5	V	V_{OUT} = 0 V	1
	V_{EE}	–18		–10.8			1
Operating current	I_{CC}		11.0	18.0	mA	V_{CC} = 5 V, V_{EE} = –15 V	6
	I_{EE}		–16.0	–22.0			
Power consumption	P_d			420	mW	V_{CC} = 5 V, V_{EE} = –15 V	6

Test circuits

Figure 1 DNL, NL, I_{FS}, I_{FSS}, I_{ZS}, P_{SS+}, and P_{SS-} test circuit

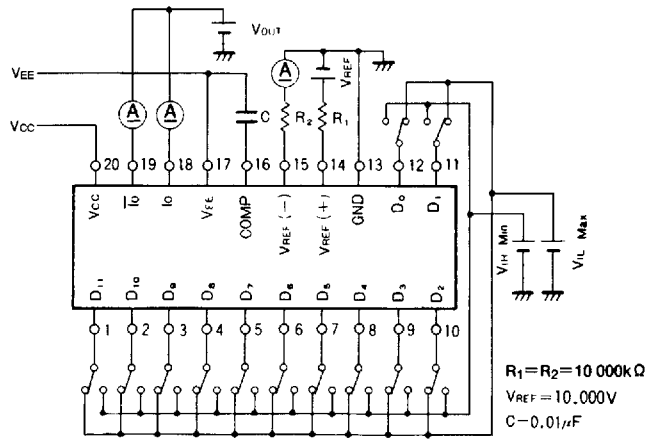


Figure 2 I_{REF} test circuit

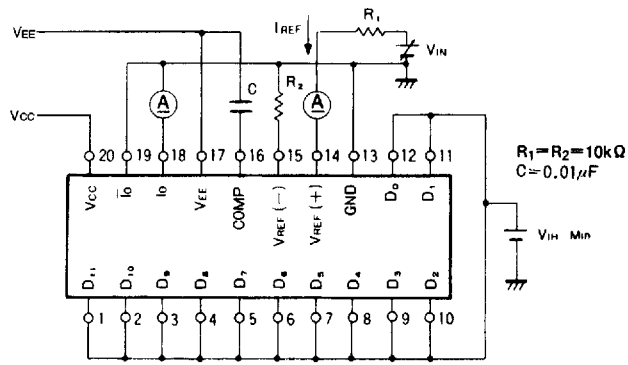


Figure 3 Setting time test circuit

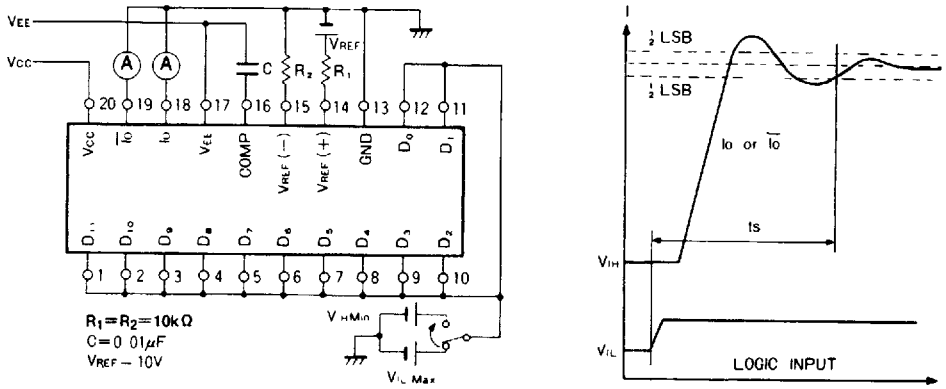


Figure 4 Reference power supply input slew rate test circuit

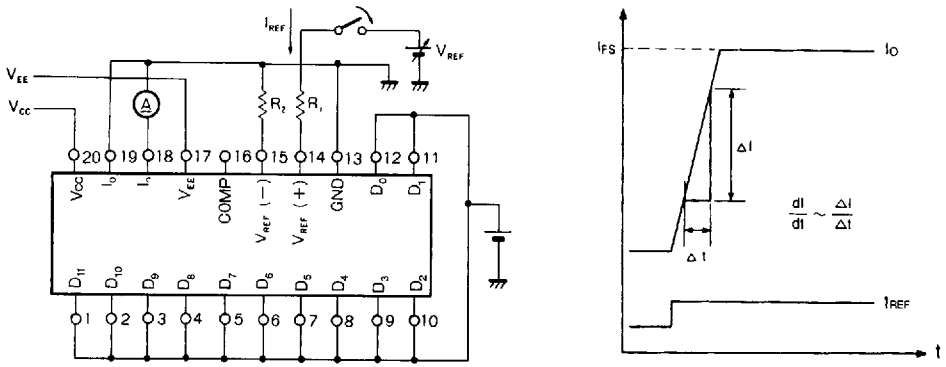


Figure 5 Input HIGH and LOW and input current I_{IN} test circuit

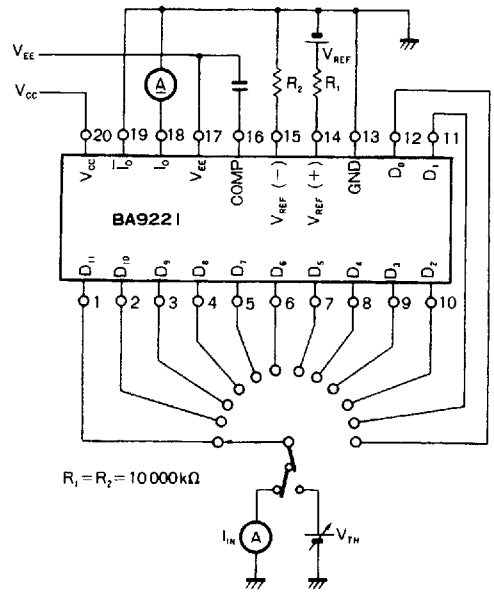


Figure 6 Circuit current I_{CC} and I_{EE} test circuit

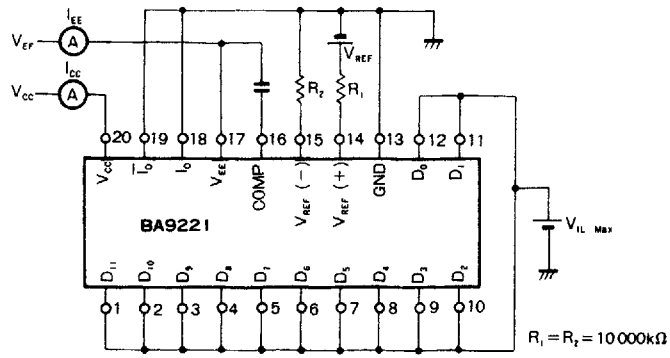


Figure 7 Application example 1—Simple D/A converter

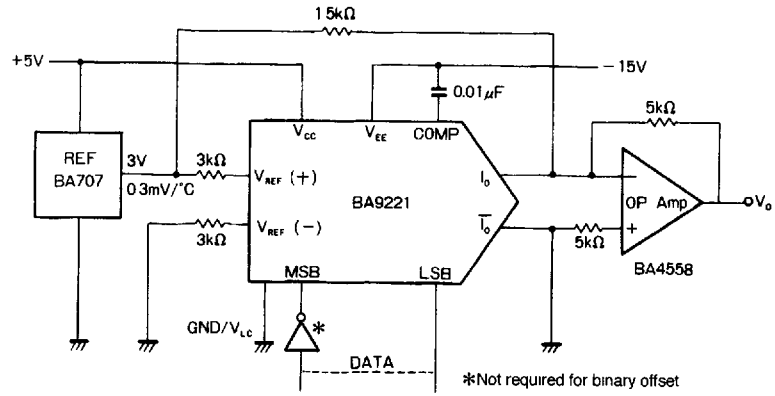
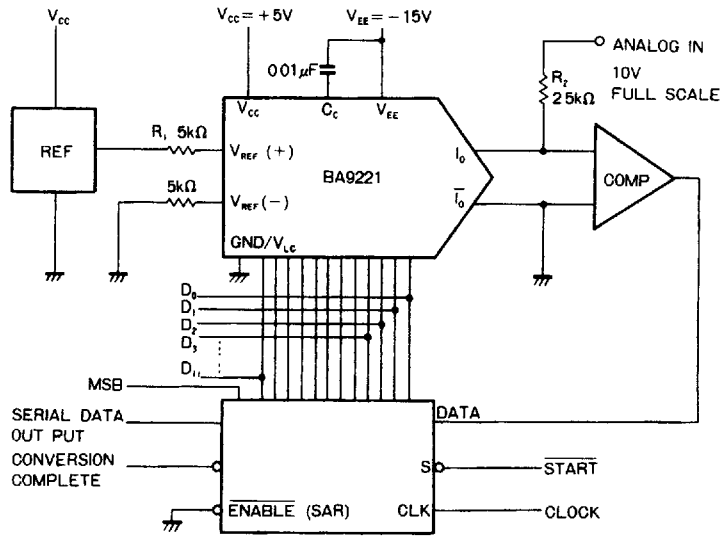


Figure 8 Application example 2—D/A converter structure



Note Adjust gain by putting potentiometer in series with R_1 or R_2

Precautions for use

The pin connections for the BA9221 and the BA9221F are different. Be careful when using these ICs interchangeably.