

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

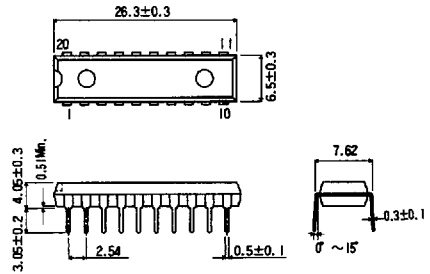
- available in DIP20 and SOP22 packages
- 12-bit monotonic conversion
- full scale current (I_{FS}) = 4 mA
- setting speed is as low as 250 ns
- built in reference supply voltage
- can be as multipliers

Applications

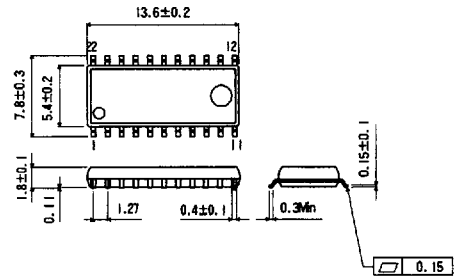
- digital audio equipment
- digital control attenuators
- electrical musical instruments
- servo controllers
- digitally controlled power supply

Dimensions (Units : mm)

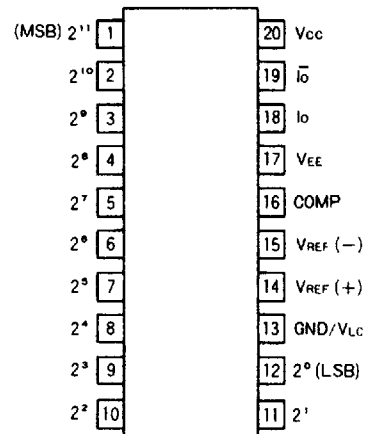
BA9221 (DIP20)



BA9221F (SOP22)

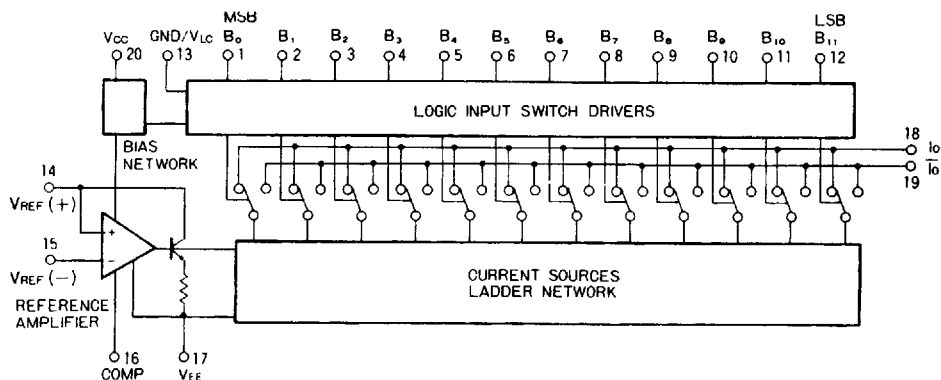


Pin connections



BA9221, BA9221F Digital-to-analog converter

Block diagram



Absolute maximum ratings ($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Limits	Unit	Conditions
Power supply voltage	V_{CC}	+7	V	
	V_{EE}	-18		
Power dissipation	BA9221	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}	$V_{EE} \sim V_{CC}$	V	
Logic input pin	V_{IN}	$-5 \sim V_{CC}$	V	
Operating temperature	BA9221	$-25 \sim +70$	°C	
	BA9221F	$-25 \sim +55$		
Storage temperature	T_{stg}	$-50 \sim +125$	°C	

Code formats

Data input		Analog output
MSB	LSB	V_O (V)
0	111111111111	9.9951
0	111111111110	9.9902
0	000000000001	0.0049
0	000000000000	0.0000
1	111111111111	-0.0049
1	000000000001	-9.9951
1	000000000000	-10.0000

Electrical characteristics ($T_a = 25^\circ\text{C}$, $V_{CC} = +5\text{ V}$, $V_{EE} = -15\text{ V}$)

Parameter	Symbol	Min	Typical	Max	Unit	Conditions	Test figure
Resolving power		12	12	12	bit		1
Monotonicity		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	$V_{REF} = 10.000\text{ V}$	1
Current temperature coefficient, full scale	TCI_{FS}		± 10		ppm/ $^\circ\text{C}$		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	$T_a = 25^\circ\text{C}$	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	$V_{IN} = 5\text{ V} \sim +5\text{ V}$	6
Reference power supply input current	I_{REF}	0.2	1.0	1.1	mA		2
Reference power supply input bias current	I_{IS}		-0.5	-2.0	μA		1
Reference power supply input slew rate	dl/dt	4.0	8.0		mA/ μs	$R_{14} = 800\ \Omega, V_{CC} = 0\ \text{pF}$	4
Power supply voltage dependance	PSS+			± 0.0001	%FS/%	$V_{EE} = 4.5\text{ V} \sim 5.5\text{ V}$, $V_{CC} = -15\text{ V}$	1
	PSS-			± 0.0001	%FS/%	$V_{EE} = 13.5\text{ V} \sim -16.5\text{ V}$, $V_{CC} = 5\text{ V}$	1
Power supply voltage	V_{CC}	4.5		5.5	V	$V_{OUT} = 0\text{ V}$	1
	V_{EE}	-18		-10.8			1
Operating current	I_{CC}		11.0	18.0	mA	$V_{CC} = 5\text{ V}, V_{EE} = -15\text{ V}$	6
	I_{EE}		-16.0	-22.0			
Power consumption	P_d			420	mW	$V_{CC} = 5\text{ V}, V_{EE} = -15\text{ V}$	6

Figure 3 Setting time test circuit

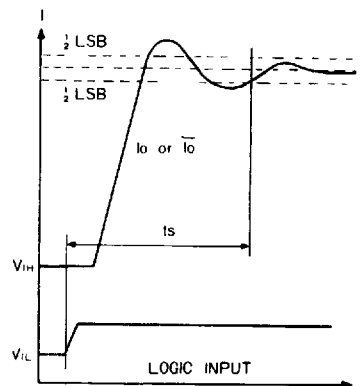
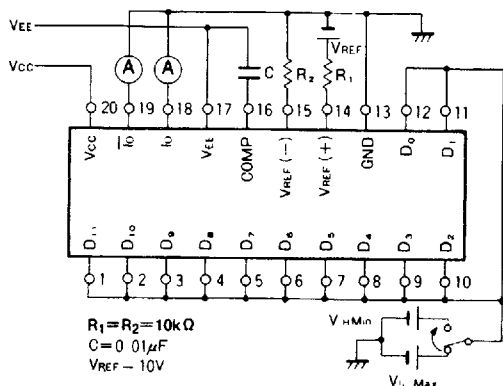


Figure 4 Reference power supply input slew rate test circuit

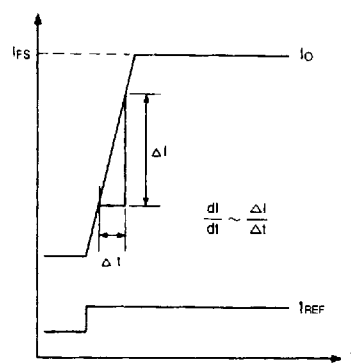
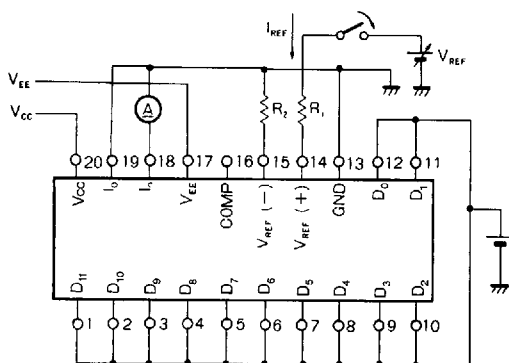


Figure 5 Input HIGH and LOW and input current I_{IN} test circuit

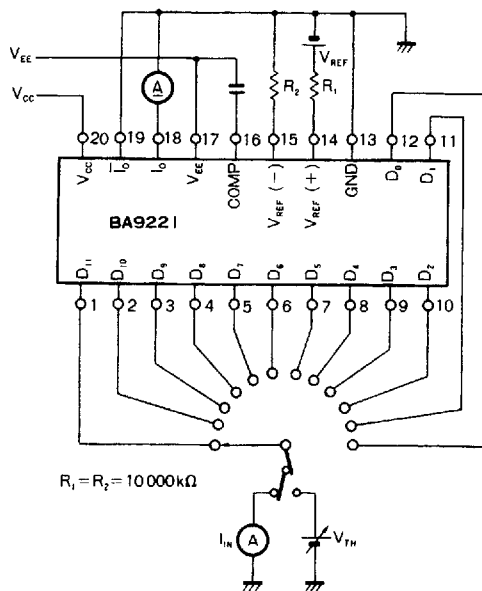


Figure 6 Circuit current I_{CC} and I_{EE} test circuit

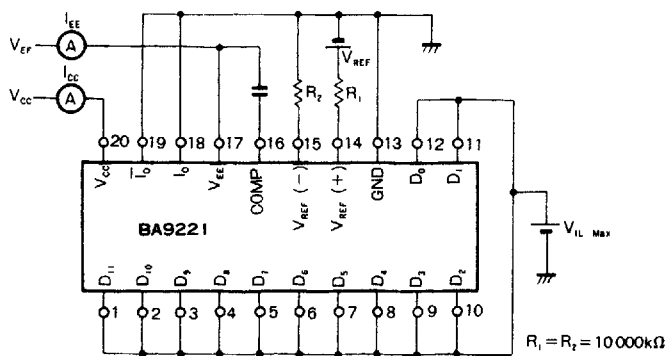


Figure 7 Application example 1—Simple D/A converter

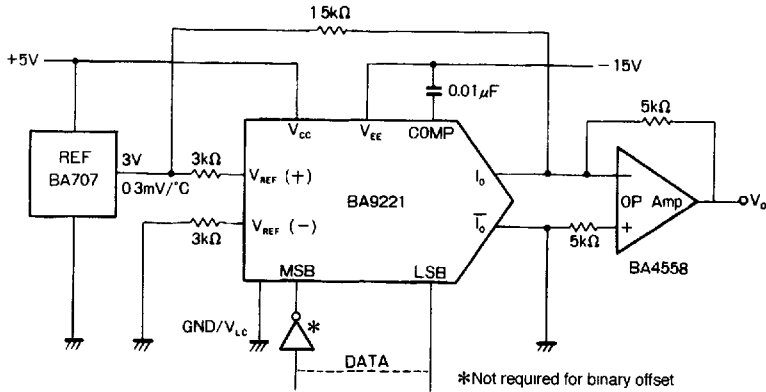
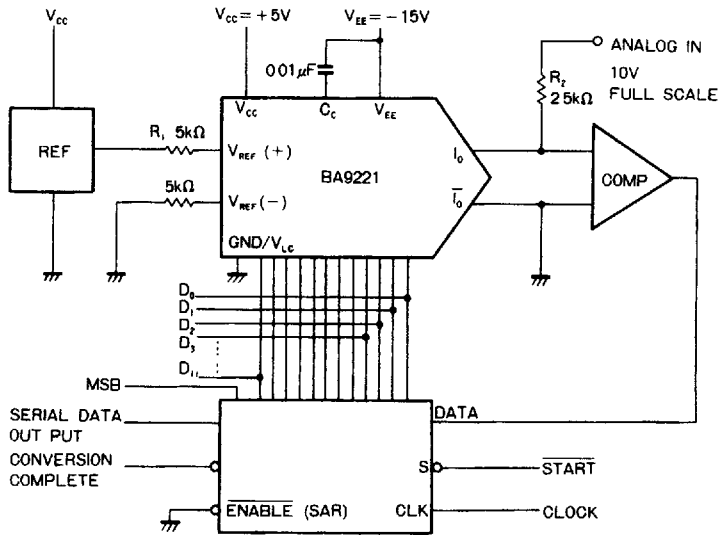


Figure 8 Application example 2—D/A converter structure



Note Adjust gain by putting potentiometer in series with R₁ or R₂

Precautions for use

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