8bit 3ch D/A converter

BH2220FVM

BH2220FVM is 8bit 3 channel D/A converter for electronic adjustment. The 3-channel DC output can be independently controlled by three-wire serial interface from micro-controller.
The D/A converter can generate without loss by Rail to Rail output within the setting voltage.
This small MSOP8 package is suitable for portable appliances.

●Applications

The voltage adjustment for DVC, DSC etc.

●Features

1) 8bit 3-channel D/A converters adopting R-2R system.
2) 3-wire 10-bit serial interface.
3) POWER ON RESET circuit.
4) The full scale output voltage range : 2.7V~5.5V.
5) MSOP8 package.

●Absolute maximum ratings (Ta=25°C)

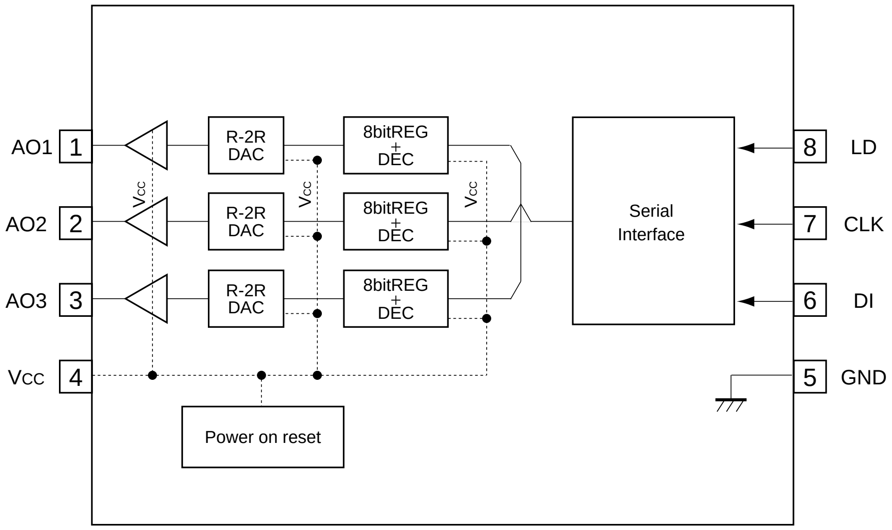
Parameter	Symbol	Limits	Unit
Power supply voltage	V_{CC}	–0.3~+7.0	V
Maximum output voltage	V_{IN}	–0.3~V_{CC}	V
Storage temperature	Tstg	–55~+125	°C
Power dissipation	Pd	310 *	mW

*Reduced by 3.1mW for each increase in Ta of 1°C over 25°C.
◎This product is not designed for protection against radioactive rays.

●Recommended operating conditions (Ta=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
V_{CC} supply voltage	V_{CC}	2.7	–	5.5	V
Analog output source current	I_{OL}	–	–	1.0	mA
Analog output sink current	I_{OH}	–	–	1.0	mA
Operating temperature range	Topr	–20	–	85	°C
Clock frequency	FSCLK	–	1.0	–	MHz
Limit load capacitance	CL	–	–	0.1	µF

●**Block diagram**



●Pin descriptions

Pin No.	Symbol	In / Out	Description
1	AO1	OUT	Analog output pins
2	AO2	OUT	
3	AO3	OUT	
4	V_{CC}	–	Power supply pin
5	GND	–	Common GND pin
6	DI	IN	Serial Data input pin
7	CLK	IN	Serial Clock input pin
8	LD	IN	Serial Load input pin

●Electrical characteristics (unless otherwise noted, Ta=25°C, V_{CC}=3.0V, R_L=OPEN, C_L=0pF)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
<Operating current> (80H set)						
V_{CC} system	I_{CC}	–	0.4	0.8	mA	CLK=1MHz
<Logic interface>						
Input low voltage	V_{IL}	GND	–	0.2V_{CC}	V	
Input high voltage	V_{IH}	0.8V_{CC}	–	V_{CC}	V	
Input low current	I_{IL}	–	–	10	µA	
Input high current	I_{IH}	–	–	10	µA	
<Buffer amplifier>						
Minimum output voltage	ZS1	GND	–	0.1	V	00H set I_{OH}=0.0mA
	ZS2	GND	–	0.2	V	00H set I_{OH}=0.5mA
	ZS3	GND	–	0.3	V	00H set I_{OH}=1.0mA
Maximum output voltage	FS1	V_{CC} –0.1	–	V_{CC}	V	FFH set I_{OL}=0.0mA
	FS2	V_{CC} –0.2	–	V_{CC}	V	FFH set I_{OL}=0.5mA
	FS3	V_{CC} –0.3	–	V_{CC}	V	FFH set I_{OL}=1.0mA
<DAC accuracy>						
Resolution	RES	–	8	–	bit	
Differential nonlinearity error	DNL	–1.0	–	1.0	LSB	Input code 02H~FDH
Nonlinearity error	INL	–1.5	–	1.5	LSB	Input code 02H~FDH

●Circuit operation

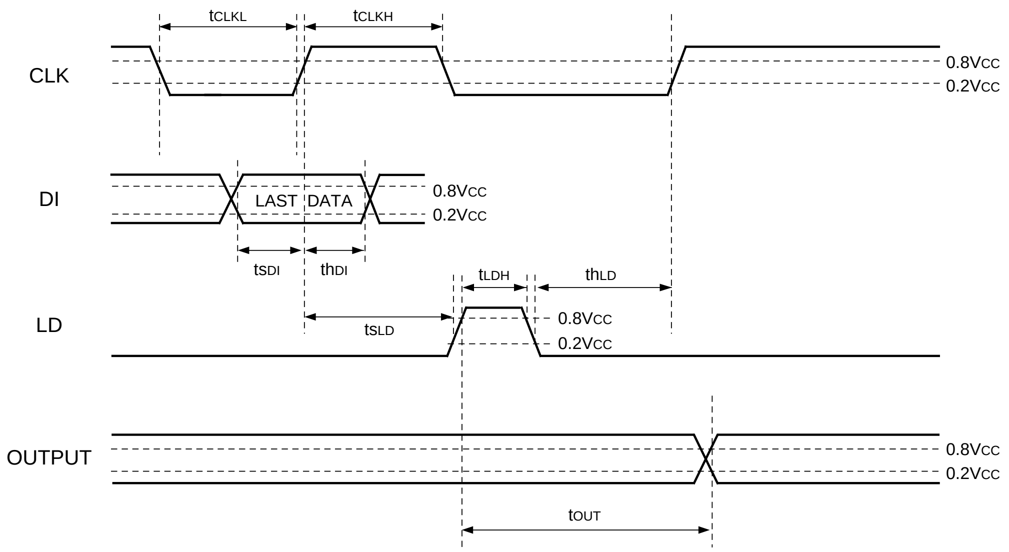
(1) Power on reset

This LSI has a power on reset circuit that sets an analog output to low level in V_{CC} power stand-up.
Please be sure that the time constant meets below condition, because the output is undefined when V_{CC} power stand up too rapidly.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
V_{CC} supply voltage rise time	TrV_{CC}	10	–	–	ms	V_{CC}=0→2.7V
Power on reset voltage	VPOR	–	1.9	–	V	

(2) Conditions of operating timing (unless otherwise noted, Ta=25°C, V_{CC}=3.0V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK L level pulse width	t_{CLKL}	200	–	–	ns	
CLK H level pulse width	t_{CLKH}	200	–	–	ns	
DI setup time	t_{SDI}	30	–	–	ns	
DI hold time	t_{hDI}	60	–	–	ns	
LD setup time	t_{SLD}	200	–	–	ns	
LD hold time	t_{hLD}	100	–	–	ns	
LD "H" level pulse width	t_{LDH}	100	–	–	ns	
Analog output delay time	t_{OUT}	–	–	300	µs	C_L=50pF, R_L=10kΩ
		–	–	100	µs	C_L=50pF, R_L=0.5MΩ



∗A signal level is judged at 80% or 20% of V_{CC}

(3) Command sending

Control command is 3wire 10bit serial interface. (MSB first)

Data is taken in with the rise edge of the CLK and output data is fixed in the LD high section.

Data is maintained in the LD low section.

LSB (LAST) MSB (FIRST)

Data set								Channel select	
D0	D1	D2	D3	D4	D5	D6	D7	D8	D9

•Data set

D0	D1	D2	D3	D4	D5	D6	D7	Analog output voltage level
0	0	0	0	0	0	0	0	GND
1	0	0	0	0	0	0	0	(Vcc-GND) / 256×1
0	1	0	0	0	0	0	0	(Vcc-GND) / 256×2
1	1	0	0	0	0	0	0	(Vcc-GND) / 256×3
0	0	1	0	0	0	0	0	(Vcc-GND) / 256×4
⋮	⋮	⋮	⋮	⋮	⋮	⋮		⋮
0	1	1	1	1	1	1	1	(Vcc-GND) / 256×254
1	1	1	1	1	1	1	1	(Vcc-GND) / 256×255

•Channel select

D8	D9	Adress select
0	0	AO1
1	0	AO2
0	1	AO3
1	1	Don't Care

●Operation notes

(1) Regarding to the DNL & INL

This item is guaranteed under below condition.

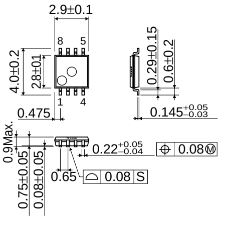
Input code 02H~FDH

(2) Regarding to the power on reset function

This function operates detecting the voltage level of the Vcc.

So, if the voltage level of the Vcc become less than power on reset voltage when working, it is a possibility that the outputs become reset condition.

●External dimensions (Units : mm)



MSOP8