

**NEW**

MITSUBISHI SEMICONDUCTOR <STANDARD LINEAR>

# M62382FP

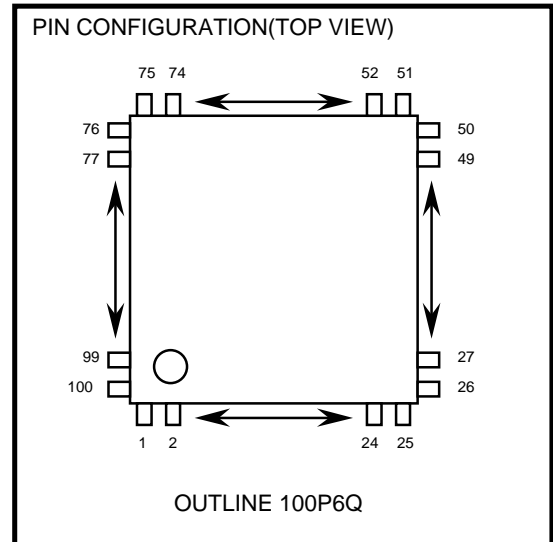
5V TYPE 12-BIT 4CH COMPOSITE MULTIPLYING D-A CONVERTER

## DESCRIPTION

M62382FP is a semiconductor integrated circuit of 5V CMOS structure with 12-bit 4 channels of built-in multiplying D-A converters and 8-bit 8 channels of built-in multiplying D-A converters. 8-bit D-A converters, when used in combination with 12-bit D-A converters, can operate in a wider range. Parallel data input under the 2 modes (A, B) of channel assignment allows for easier usage.

## FEATURES

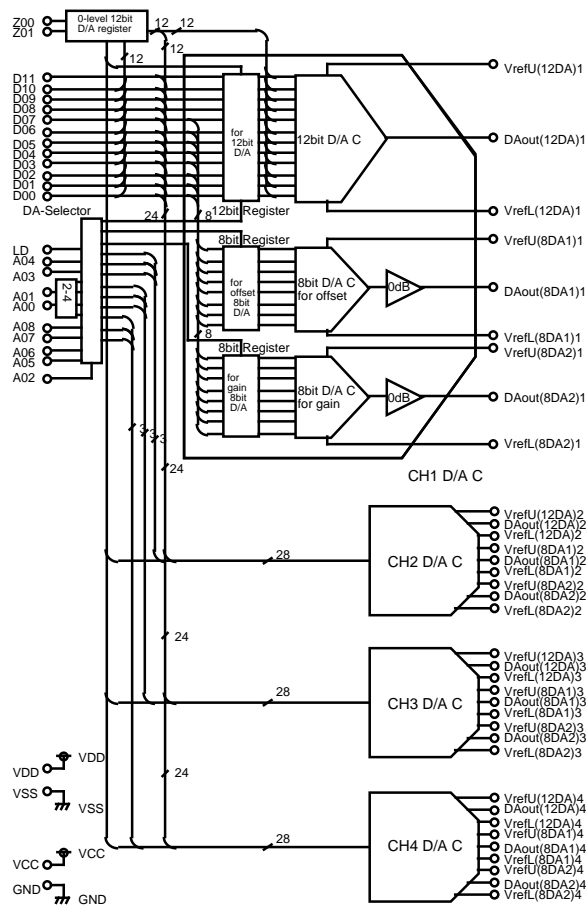
- Built-in low power 12-bit 4 channels D-A converters
  - 8-bit D-A converter with buffer making full swing between Vcc and GND.
  - 2 modes (A, B) of channel assignment
  - Zero level function
- Built-in function of retaining arbitrary assigned data in 12-bit D-A converter. In normal use, output voltage can be switched to the voltage corresponding to the formerly assigned data by the setting of Z01, making it possible to calibrate the data (output voltage value).



## APPLICATION

- High precision measurement equipments such as memory testers, industrial measurement equipments, medical equipments, standard equipments in general

## BLOCK DIAGRAM



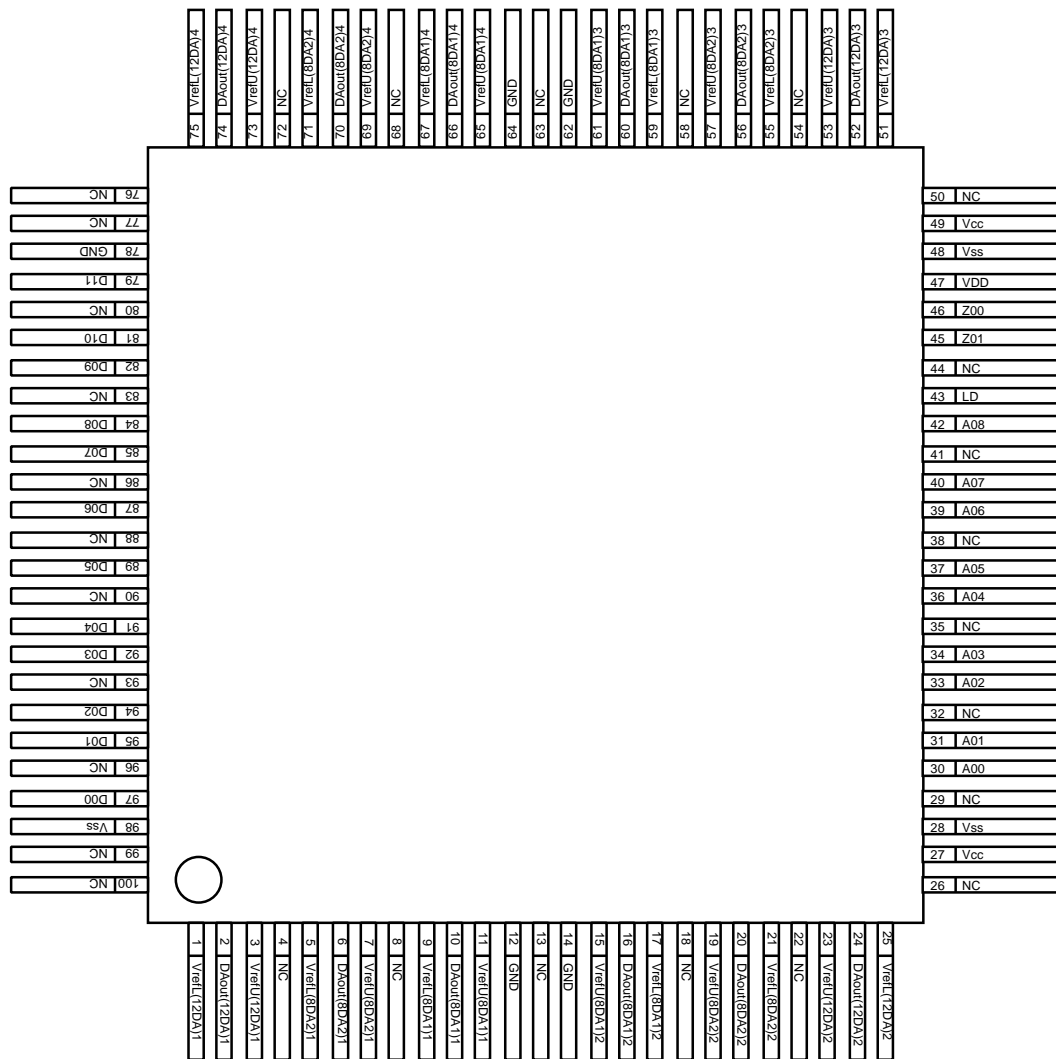
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## PIN CONFIGURATION(TOP VIEW)



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**EXPLANATION OF TERMINALS**

PinNo.	Symbol	Function
1,25,51,75	VrefL(12)	12-bit D-A converter lower reference voltage input terminal
2,24,52,74	DAout(12)	12-bit D-A converter output terminal
3,23,53,73	VrefU(12)	12-bit D-A converter upper reference voltage input terminal
5,9,17,21, 55,59,67,71	VrefL(8)	8-bit D-A converter lower reference voltage input terminal
6,10,16,20,56, 60,66,70	DAout(8)	8-bit D-A converter output terminal
7,11,15,19,57, 61,65,69	VrefU(8)	8-bit D-A converter upper reference voltage input terminal
27,49	Vcc	Analog power supply terminal
12,14,62,64,78	GNG	Analog GND terminal
47	VDD	Digital power supply terminal
28,48,98	Vss	Digital GND terminal
30,31,33,34,36, 37,39,40,42	A00~A08	Address terminal
79,81,82,84,85, 87,89,91,92,94, 95,97	D00~D11	D-A data terminal
43	LD	D-A LD terminal
46	Z00	Zero level data assignment terminal
45	Z01	Zero level data load terminal
4,8,13,18,22,29, 32,35,38,41,44, 50,54,58,63,68, 72,76,77,80,83, 86,88,90,93,96, 99,100	NC	Non-connection



# M62382FP

## 5V TYPE 12-BIT 4CH COMPOSITE MULTIPLYING D-A CONVERTER

### 1. ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Ratings	Unit
VDD	Digital supply voltage	-0.3 to +7.0	V
VCC	Analog supply voltage	-0.3 to +7.0	V
VDIN	Digital input voltage	-0.3 to VDD+0.3 7.0	V
Vref	D/A reference voltage	-0.3 to VDD+0.3 7.0	V
VDAout	D/A output voltage	-0.3 to VDD+0.3 7.0	V
topr	Operating temperature	-20 to +85	°C
tstr	Storage temperature	-40 to +125	°C

### 2. ELECTRICAL CHARACTERISTICS

(1) Digital part (VDD=VCC=5V, VSS=GND(=0V), VrefU=VCC, VrefL=GND, Ta=-20 to +85°C, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
IDD	Digital supply current	fLD=1MHz, VDIN=VSS, or VDD			3.0	mA
IILK	Input leak current	VDIN=VSS to VDD	-10		+10	μA
CIN	Input capacitive load				1.2	pF

(2) Analog part (VDD=VCC=5V, VSS=GND(=0V), VrefU=VCC, VrefL=GND, Ta=-20 to +85°C, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
ICC	Analog supply current	D/A output=1/2MSB		1.6	6.0	mA
Iref	Reference current for D/A converter(U to L)	D/A data for maximum current of D/A reference, each circuit current from VrefU to VrefL		0.7	2.0	mA
		12bitD/A				
		8bitD/A		0.1	0.4	
IOA	Buffer amplifier output drive range	Upper side saturation voltage=0.3V Lower side saturation voltage=0.3V	±1.5			mA
RO	Output Resistance	12bitD/A:R-2R ladder output		2.2		k
		8bitD/A:Buffer amplifier output		10		
SDL	Differential nonlinearity error	VrefU=5.0V, VrefL=0.0V Ta=25°C	12bitD/A	-1.5	+1.5	LSB
			8bitD/A	-1.0	+1.0	
SNL	Nonlinearity error	VrefU=5.0V, VrefL=0.0V Ta=25°C	12bitD/A	-2.0	+2.0	LSB
			8bitD/A	-1.0	+1.0	
SZERO	Zero code error	VrefU=5.0V, VrefL=0.0V, Ta=25°C	-3.0		+3.0	LSB
SFULL	Full code error	VrefU=5.0V, VrefL=0.0V, Ta=25°C	-3.0		+3.0	LSB
NL/t	Temperature coefficient of nonlinearity error	VrefU=5.0V, VrefL=0.0V SNL12bitD/A /60°C (Ta=25 to 85°C)		0.009		LSB/°C
CT	Cross talk between the channels	Vin=-10dBm, f=100Hz to 1kHz	12bitD/A	75		dB
			8bitD/A	65		
PSRR	Power supply rejection ratio	VCCin=VCC-10dBm f=100Hz to 1kHz	12bitD/A	65		dB
			8bitD/A	55		
TCO	Temperature coefficient of D/A output			20		ppm/°C
tSTDA	Settling time of 12bitD/A	Without load (IOA=0mA)		1.4		μs
tstDA	Settling time of 8bitD/A	Until output takes 1/2LSB of the final value		70		μs



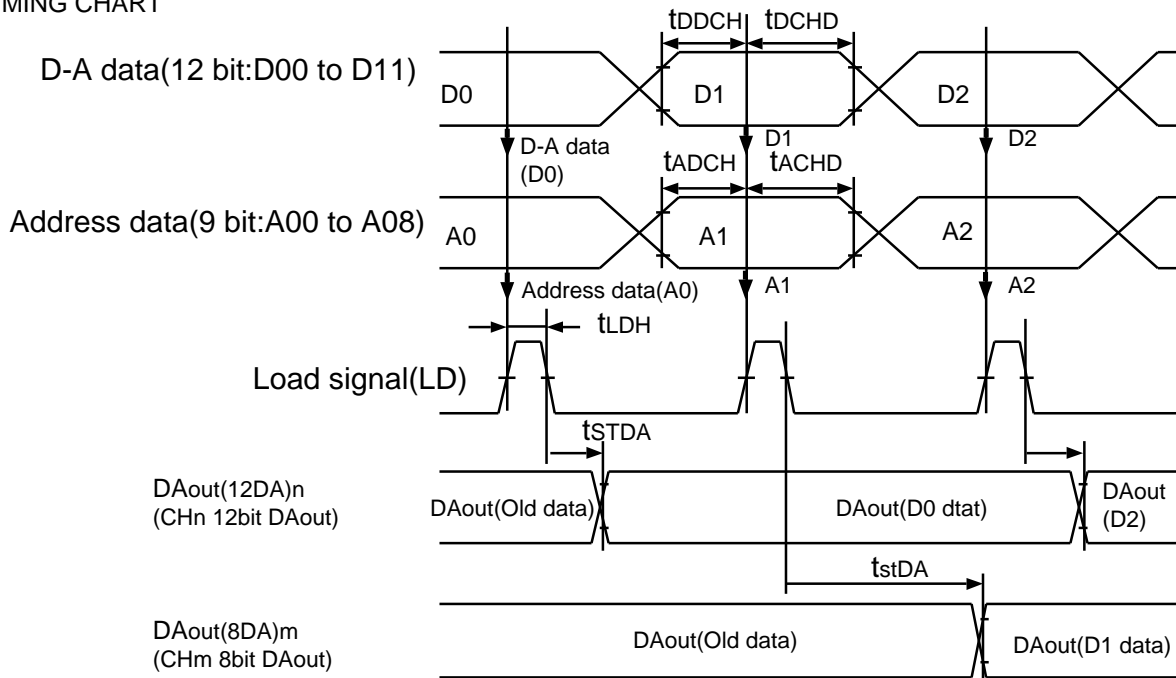
# M62382FP

## 5V TYPE 12-BIT 4CH COMPOSITE MULTIPLYING D-A CONVERTER

RECOMMENDED OPERATING CONDITION (Ta=25°C to 75°C)

Symbol	Parameter	Condition	Limits			Unit
			Min.	Typ.	Max.	
VCC	Analog power supply voltage		4.5	5.0	5.5	V
VDD	Digital power supply voltage		4.5	5.0	5.5	V
VrefH	H side D-A reference voltage		VCC-0.5		VCC	V
VrefL	L side D-A reference voltage		GND		0.5	V
VIH	H level digital input voltage		2		VDD	V
VIL	L level digital input voltage		GND		0.8	V
tDDCH	D-A data set up time	Driving 12bit and 8bit D-A converters at same time	10			ns
tADCH	Address data set up time	Driving 12bit and 8bit D-A converters at same time	150			ns
tDCHD	D-A data hold time	Driving 12bit and 8bit D-A converters at same time	tLDH+35			ns
tACHD	Address data hold time	Driving 12bit and 8bit D-A converters at same time	tLDH+10			ns
tLDH	Load signal H level hold time	Driving 12bit and 8bit D-A converters at same time	100			ns
tZSH	Z00 signal H level hold time		15			ns

TIMING CHART



Zero level setting (input/output) : Z00, Z01

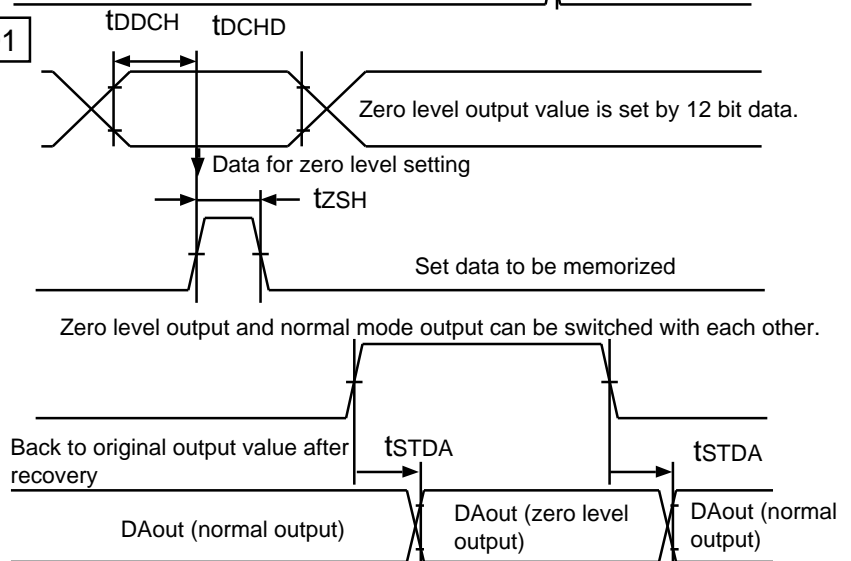
Data for D/A converter (D00-D11: 12bit data)

Zero level setting signal(Z00)  
 \*Data sampling when signal rises, data retained when signal falls.

Zero level load signal (Z01)  
 \*D/A output zero level at signal rise, D/A output recovered at signal fall.

12bit DAC output

DAout(12DA) (12bit DAout)





# M62382FP

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## Digital format

### 1. Channel select setting (A01, A02)

setting select	A01	A00
CH1 select	0	0
CH2 select	0	1
CH3 select	1	0
CH4 select	1	1

### 2. Channel assign mode setting (A02)

Channel assign mode setting	A02
A channel assign mode	0
B channel assign mode	1

### 3. 8bit D/A converter select setting (A03)

8bit D/A converter select setting	A03
D/A select for offset	0
D/A select for gain	1

### 4. D/A converter select setting (A04)

D/A converter select setting	A04
12bit D/A converter select	0
8bit D/A converter select	1

### 5. Channel select setting B(A05,A06,A07,A08)

setting select	A05	A06	A07	A08
CH1 select	1	0	0	0
CH2 select	0	1	0	0
CH3 select	0	0	1	0
CH4 select	0	0	0	1

### 12bit D-A

D00	D01	D02	D03	D04	D05	D06	D07	D08	D09	D10	D11	D-A output
0	0	0	0	0	0	0	0	0	0	0	0	VrefL12
1	0	0	0	0	0	0	0	0	0	0	0	(VrefU12-VrefL12)/4096X1
0	1	0	0	0	0	0	0	0	0	0	0	(VrefU12-VrefL12)/4096X2
1	1	0	0	0	0	0	0	0	0	0	0	(VrefU12-VrefL12)/4096X3
:	:	:	:	:	:	:	:	:	:	:	:	:
0	0	1	1	1	1	1	1	1	1	1	1	(VrefU12-VrefL12)/4096X4092
1	0	1	1	1	1	1	1	1	1	1	1	(VrefU12-VrefL12)/4096X4093
0	1	1	1	1	1	1	1	1	1	1	1	(VrefU12-VrefL12)/4096X4094
1	1	1	1	1	1	1	1	1	1	1	1	(VrefU12-VrefL12)/4096X4095

### 8bit D-A

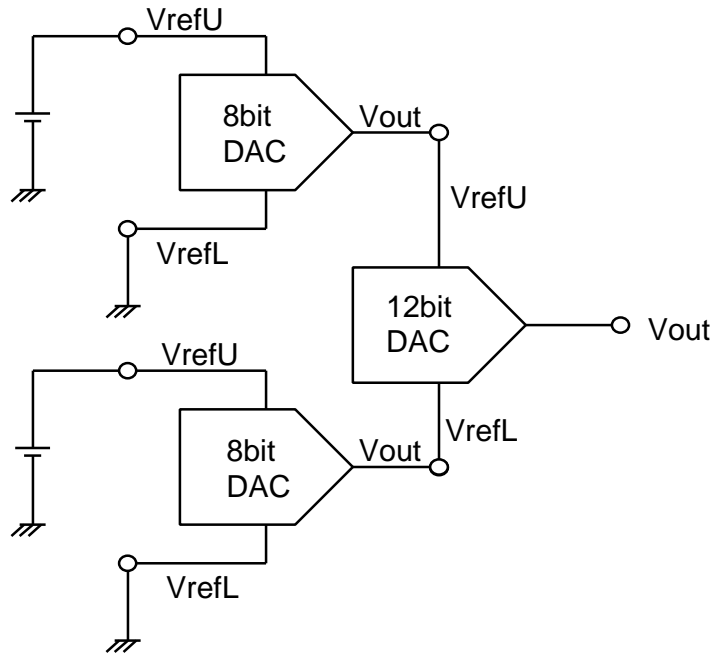
D00	D01	D02	D03	D04	D05	D06	D07	D08	D09	D10	D11	D-A output
0	0	0	0	0	0	0	0	—	—	—	—	VrefL8
1	0	0	0	0	0	0	0	—	—	—	—	(VrefU8-VrefL8)/256X1
0	1	0	0	0	0	0	0	—	—	—	—	(VrefU8-VrefL8)/256X2
1	1	0	0	0	0	0	0	—	—	—	—	(VrefU8-VrefL8)/256X3
:	:	:	:	:	:	:	:	:	:	:	:	:
0	0	1	1	1	1	1	1	—	—	—	—	(VrefU8-VrefL8)/256X252
1	0	1	1	1	1	1	1	—	—	—	—	(VrefU8-VrefL8)/256X253
0	1	1	1	1	1	1	1	—	—	—	—	(VrefU8-VrefL8)/256X254
1	1	1	1	1	1	1	1	—	—	—	—	(VrefU8-VrefL8)/256X255

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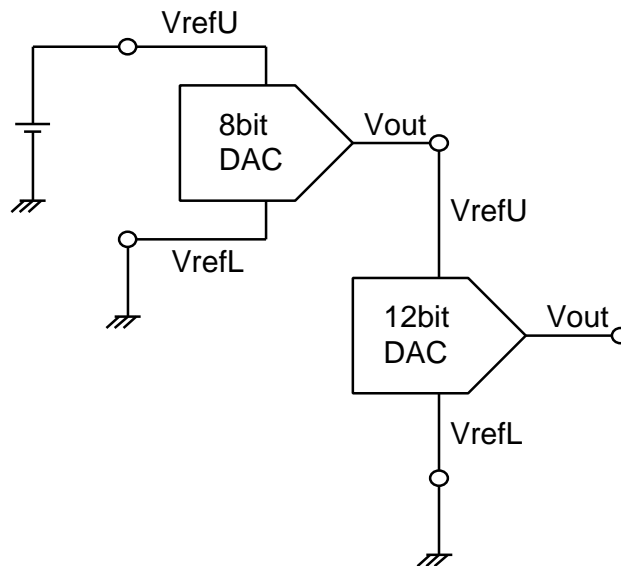
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## 8bit D-Aconverter for reference voltage power supply



Arbitrary voltage can be set without the connection to power supply by connecting the output terminal of 8bit D-A converter with upper reference voltage and lower reference voltage of 12bit D-A converter.

## Ultra high precision D-A converter



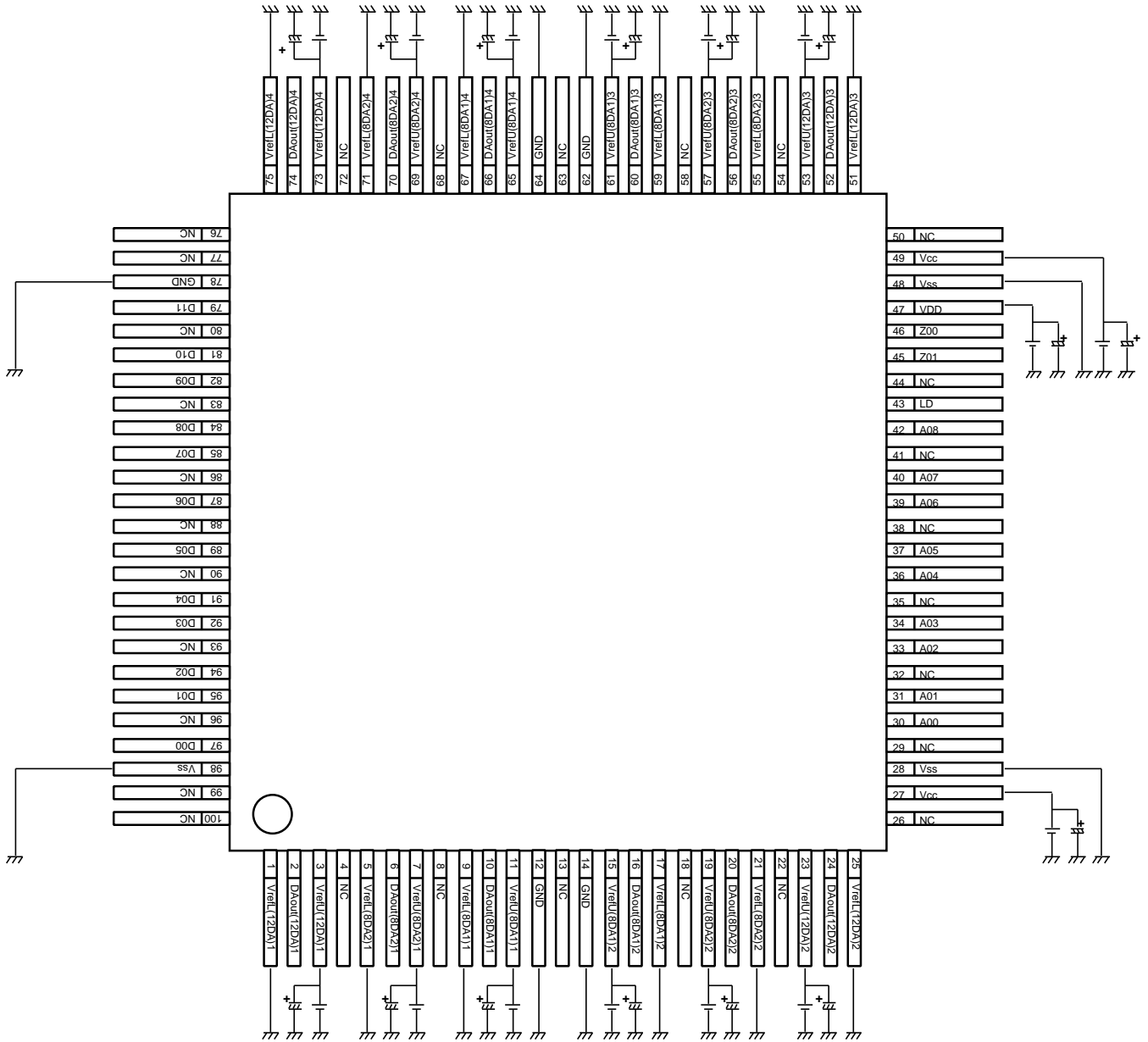
By connecting the output terminal of 8bit D-A converter with the upper reference voltage of 12bit D-A converter, D-A converter equivalent to 20bit is configured to have higher precision configuration. If more minute output variation is needed, 8bit D-A converter can be utilized for compensation like this.

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## Application circuit



### Caution :

This IC has four different kinds of terminals which are to be applied by constant voltage when used. (VCC, VDD, VrefU, VrefL)

D-A converter precision may be worsened when ripple voltage or spike is duplicated on these four terminals.

So please be sure to put capacitor between each terminal and GND for stabilized D-A converter operation.