M62382FP

5 V Type 12-bit 4ch Composite Multiplying D/A Converter

REJ03D0882-0300
Rev.3.00
Mar 25, 2008

Description

The M62382FP is a semiconductor integrated circuit of 5 V 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.

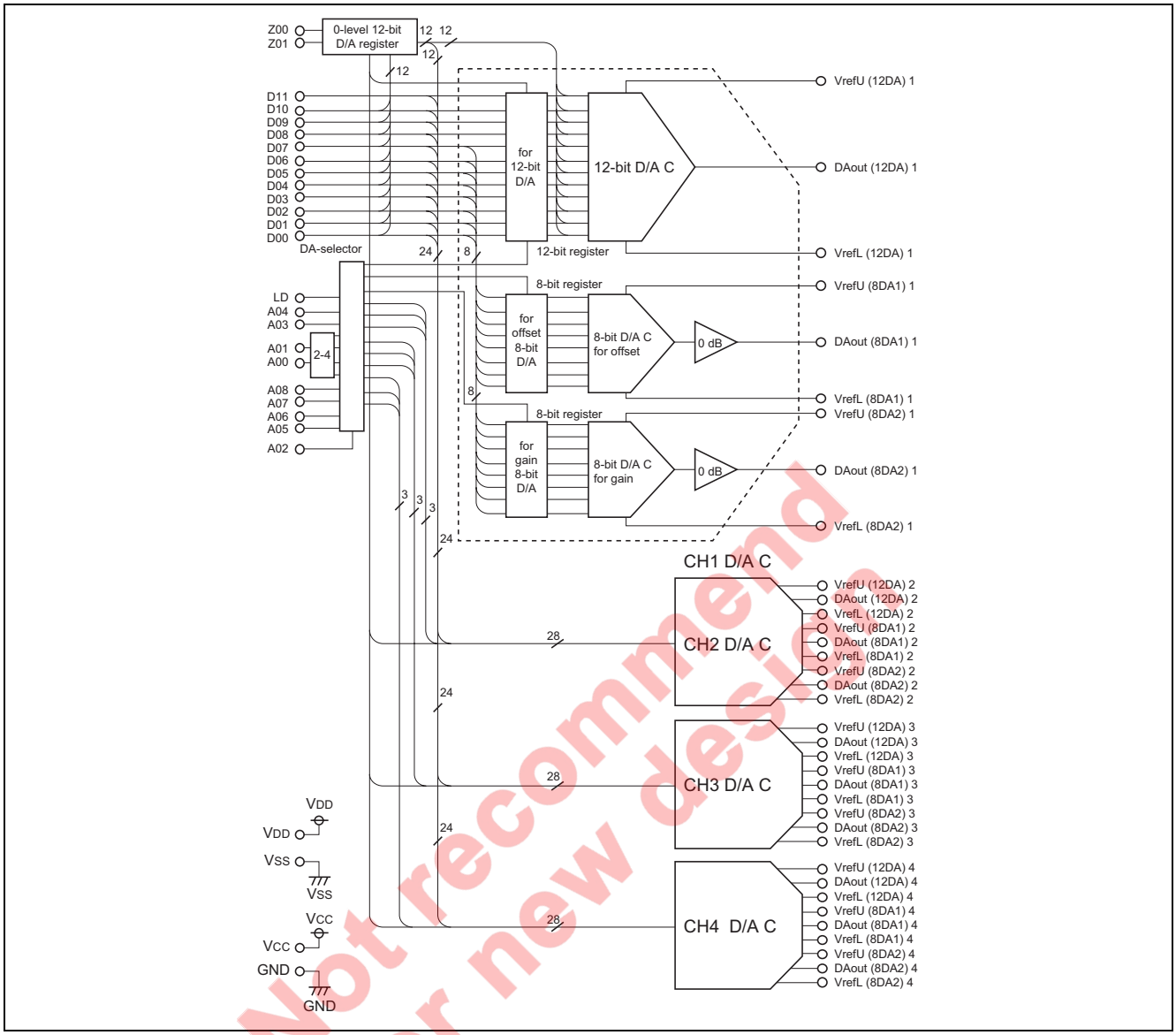
Features

- Built-in low power 12-bit 4 channels D/A converters
- 8-bit D/A converter with buffer making full swing between V_{CC} 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).

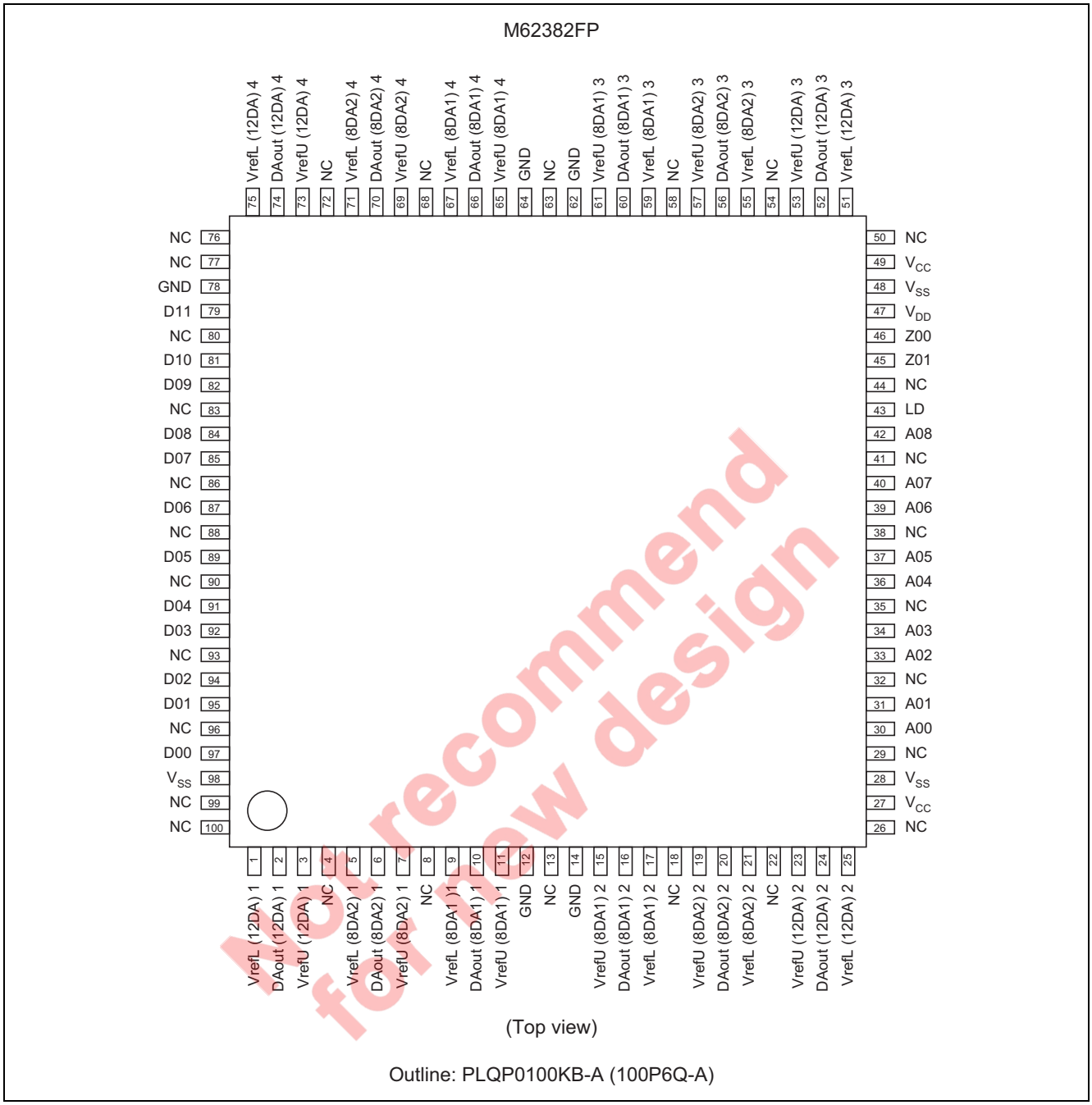
Application

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

Block Diagram



Pin Arrangement



(Top view)

Outline: PLQP0100KB-A (100P6Q-A)

Pin Description

Pin No.	Pin Name	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	V_{CC}	Analog power supply terminal
12, 14, 62, 64, 78	GND	Analog GND terminal
47	V_{DD}	Digital power supply terminal
28, 48, 98	V_{SS}	Digital GND terminal
30, 31, 33, 34, 36, 37, 39, 40, 42	A00 to A08	Address terminal
79, 81, 82, 84, 85, 87, 89, 91, 92, 94, 95, 97	D00 to 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

Absolute Maximum Ratings

Item	Symbol	Ratings	Unit
Digital supply voltage	V_{DD}	–0.3 to +7.0	V
Analog supply voltage	V_{CC}	–0.3 to +7.0	V
Digital input voltage	V_{DIN}	–0.3 to V_{DD} + 0.3 ≤ 7.0	V
D/A reference voltage	Vref	–0.3 to V_{DD} + 0.3 ≤ 7.0	V
D/A output voltage	VDAout	–0.3 to V_{DD} + 0.3 ≤ 7.0	V
Operating temperature	Topr	–20 to +85	°C
Storage temperature	Tstr	–40 to +125	°C

Electrical Characteristics

<Digital Part>

(V_{DD} = V_{CC} = 5 V, V_{SS} = GND (= 0 V), VrefU = V_{CC}, VrefL = GND, Ta = –20 to +85°C, unless otherwise noted.)

Item	Symbol	Limits			Unit	Conditions
		Min	Typ	Max		
Digital supply current	I_{DD}	—	—	3.0	mA	f_{LD} = 1 MHz, V_{DIN} = V_{SS}, or V_{DD}
Input leak current	I_{ILK}	–10	—	+10	µA	V_{DIN} = V_{SS} to V_{DD}
Input capacitive load	C_{IN}	—	—	1.2	pF	

<Analog Part>

(V_{DD} = V_{CC} = 5 V, V_{SS} = GND (= 0 V), VrefU = V_{CC}, VrefL = GND, Ta = –20 to +85°C, unless otherwise noted.)

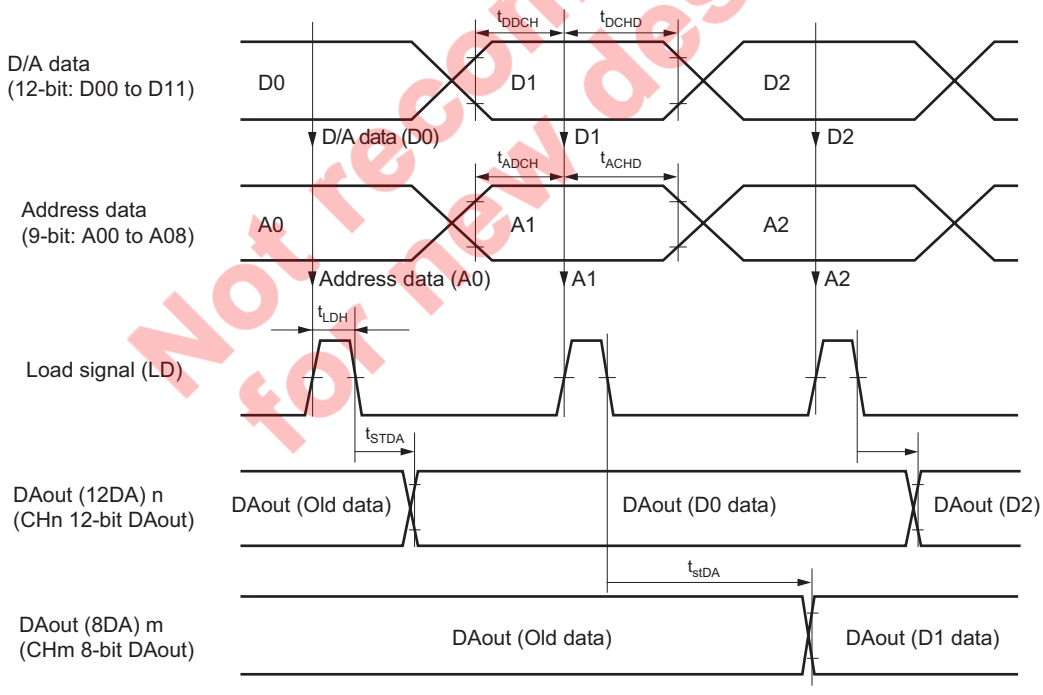
Item	Symbol	Limits			Unit	Conditions	
		Min	Typ	Max			
Analog supply current	I_{CC}	—	1.6	6.0	mA	D/A output = 1/2 MSB	
Reference current for D/A converter (U to L)	Iref	—	0.7	2.0	mA	12-bit D/A	D/A data for maximum current of D/A reference, each circuit current from VrefU to VrefL
		—	0.1	0.4	mA	8-bit D/A	
Buffer amplifier output drive range	I_{OA}	±1.5	—	—	mA	Upper side saturation voltage = 0.3 V Lower side saturation voltage = 0.3 V	
Output resistance	R_O	—	2.2	—	kΩ	12-bit D/A: R-2R ladder output	
		—	10	—	Ω	8-bit D/A: Buffer amplifier output	
Differential nonlinearity error	S_{DL}	–1.5	—	+1.5	LSB	12-bit D/A	VrefU = 5.0 V, VrefL = 0.0 V
		–1.0	—	+1.0		8-bit D/A	Ta = 25°C
Nonlinearity error	S_{NL}	–2.0	—	+2.0	LSB	12-bit D/A	VrefU = 5.0 V, VrefL = 0.0 V
		–1.0	—	+1.0		8-bit D/A	Ta = 25°C
Zero code error	S_{ZERO}	–3.0	—	+3.0	LSB	VrefU = 5.0 V, VrefL = 0.0 V Ta = 25°C	
Full code error	S_{FULL}	–3.0	—	+3.0	LSB	VrefU = 5.0 V, VrefL = 0.0 V Ta = 25°C	
Temperature coefficient of nonlinearity error	ΔNL/t	—	—	0.05	LSB/°C	VrefU = 5.0 V, VrefL = 0.0 V $S_{NL\ 12\text{-}bit\ D/A}$ / 60°C (Ta = 25 to 85°C)	
Cross talk between the channels	CT	—	75	—	dB	12-bit D/A	Vin = –10 dBm
		—	65	—		8-bit D/A	f = 100 Hz to 1 kHz
Power supply rejection ratio	PSRR	—	65	—	dB	12-bit D/A	V_{CCin} = V_{CC} – 10 dBm
		—	55	—		8-bit D/A	f = 100 Hz to 1 kHz
Temperature coefficient of D/A output	TCo	—	20	—	ppm/°C		
Settling time of 12-bit D/A	t_{STDA}	—	1.4	—	µs	Without load (I_{OA} = 0 mA)	
Settling time of 8-bit D/A	t_{stDA}	—	70	—	µs	Until output takes 1/2 LSB of the final value	

Recommended Operating Condition

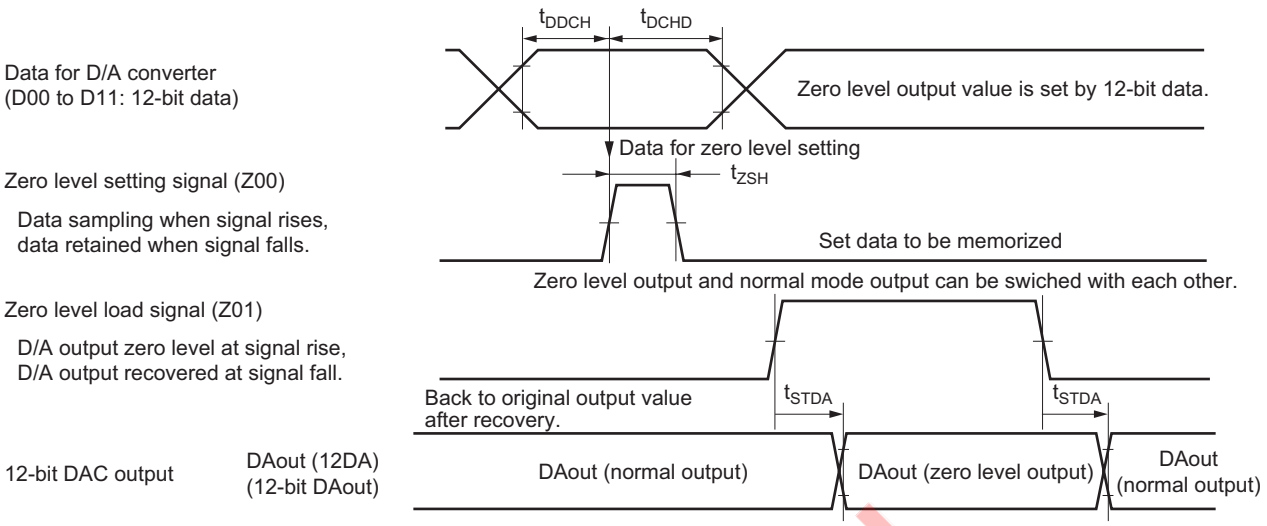
(Ta = 25 to 75°C)

Item	Symbol	Limits			Unit	Conditions
		Min	Typ	Max		
Analog power supply voltage	V_{CC}	4.5	5.0	5.5	V	
Digital power supply voltage	V_{DD}	4.5	5.0	5.5	V	
H side D/A reference voltage	VrefH	V_{CC} – 0.5	—	V_{CC}	V	
L side D/A reference voltage	VrefL	GND	—	0.5	V	
H level digital input voltage	V_{IH}	2	—	V_{DD}	V	
L level digital input voltage	V_{IL}	GND	—	0.8	V	
D/A data set up time	t_{DDCH}	10	—	—	ns	Driving 12-bit and 8-bit D/A converters at same time
Address data set up time	t_{ADCH}	150	—	—	ns	Driving 12-bit and 8-bit D/A converters at same time
D/A data hold time	t_{DCHD}	t_{LDH} + 35	—	—	ns	Driving 12-bit and 8-bit D/A converters at same time
Address data hold time	t_{ACHD}	t_{LDH} + 10	—	—	ns	Driving 12-bit and 8-bit D/A converters at same time
Load signal H level hold time	t_{LDH}	100	—	—	ns	Driving 12-bit and 8-bit D/A converters at same time
Z00 signal H level hold time	t_{ZSH}	15	—	—	ns	

Timing Chart



Zero Level Setting (input/output): Z00, Z01



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. 8-bit D/A Converter Select Setting (A03)

8-bit 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
12-bit D/A converter select	0
8-bit 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

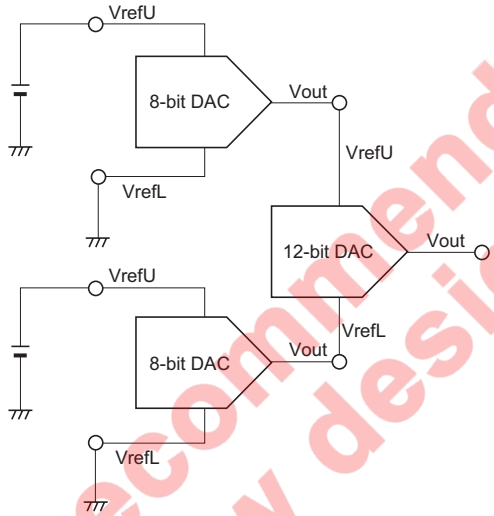
12-bit D/A

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) / 4096 × 1
0	1	0	0	0	0	0	0	0	0	0	0	(VrefU12 – VrefL12) / 4096 × 2
1	1	0	0	0	0	0	0	0	0	0	0	(VrefU12 – VrefL12) / 4096 × 3
:	:	:	:	:	:	:	:	:	:	:	:	:
0	0	1	1	1	1	1	1	1	1	1	1	(VrefU12 – VrefL12) / 4096 × 4092
1	0	1	1	1	1	1	1	1	1	1	1	(VrefU12 – VrefL12) / 4096 × 4093
0	1	1	1	1	1	1	1	1	1	1	1	(VrefU12 – VrefL12) / 4096 × 4094
1	1	1	1	1	1	1	1	1	1	1	1	(VrefU12 – VrefL12) / 4096 × 4095

8-bit D/A

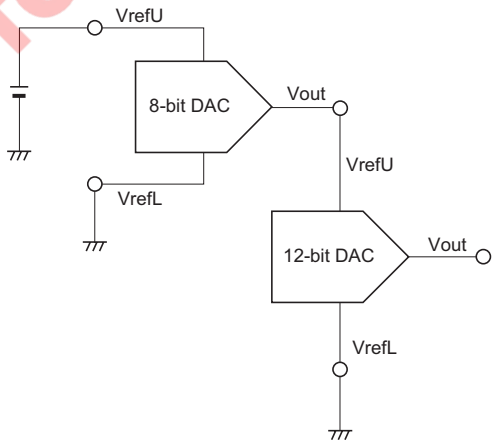
D00	D01	D02	D03	D04	D05	D06	D07	D08	D09	D10	D11	D/A Output
0	0	0	0	0	0	0	0	—	—	—	—	VrefL8
1	0	0	0	0	0	0	0	—	—	—	—	(VrefU8 – VrefL8) / 256 × 1
0	1	0	0	0	0	0	0	—	—	—	—	(VrefU8 – VrefL8) / 256 × 2
1	1	0	0	0	0	0	0	—	—	—	—	(VrefU8 – VrefL8) / 256 × 3
:	:	:	:	:	:	:	:	:	:	:	:	:
0	0	1	1	1	1	1	1	—	—	—	—	(VrefU8 – VrefL8) / 256 × 252
1	0	1	1	1	1	1	1	—	—	—	—	(VrefU8 – VrefL8) / 256 × 253
0	1	1	1	1	1	1	1	—	—	—	—	(VrefU8 – VrefL8) / 256 × 254
1	1	1	1	1	1	1	1	—	—	—	—	(VrefU8 – VrefL8) / 256 × 255

8-bit D/A Converter for Reference Voltage Power Supply



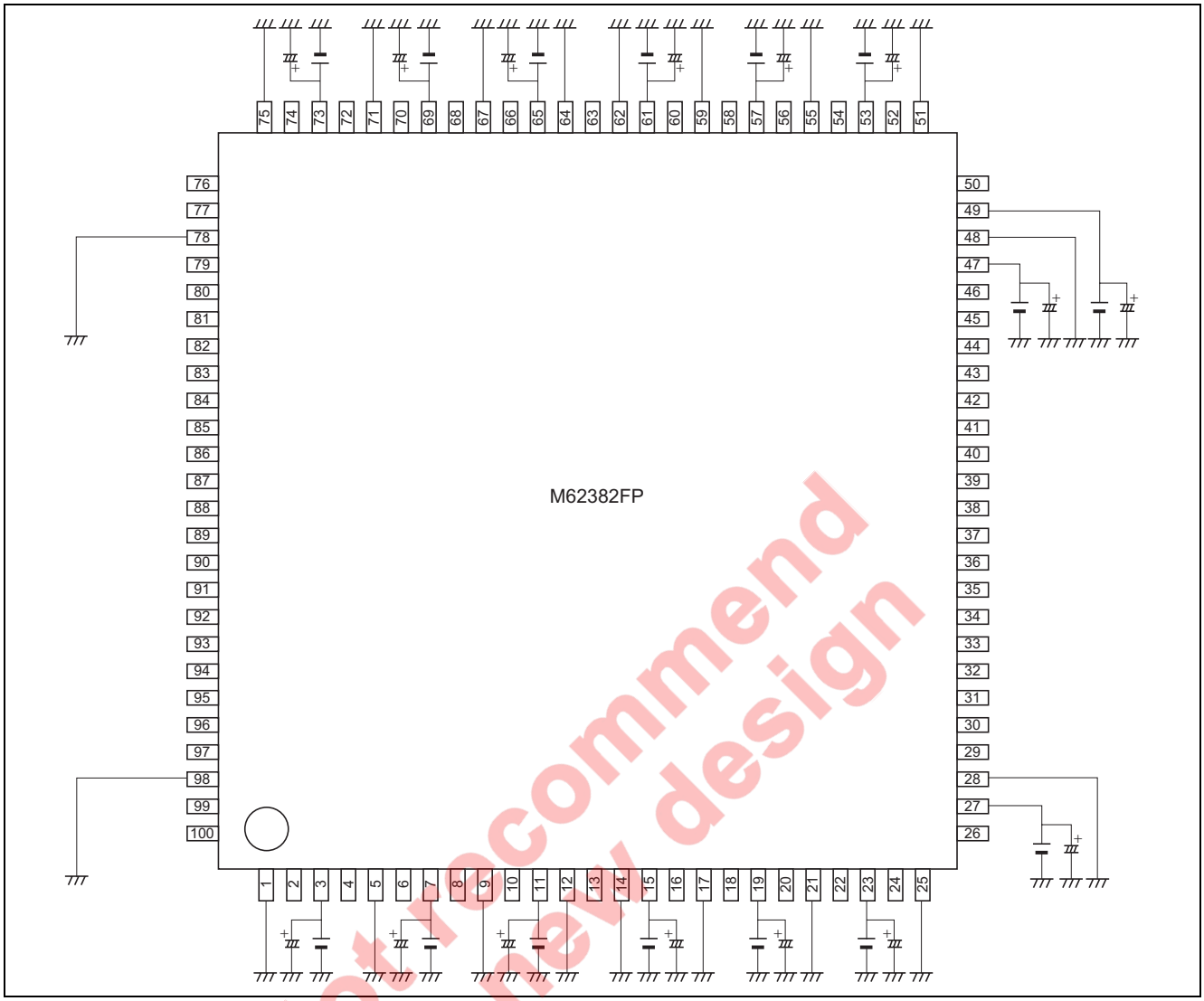
Note: Arbitrary voltage can be set without the connection to power supply by connecting the output terminal of 8-bit D/A converter with upper reference voltage and lower reference voltage of 12-bit D/A converter.

Ultra High Precision D/A Converter



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

Application Circuit



Caution

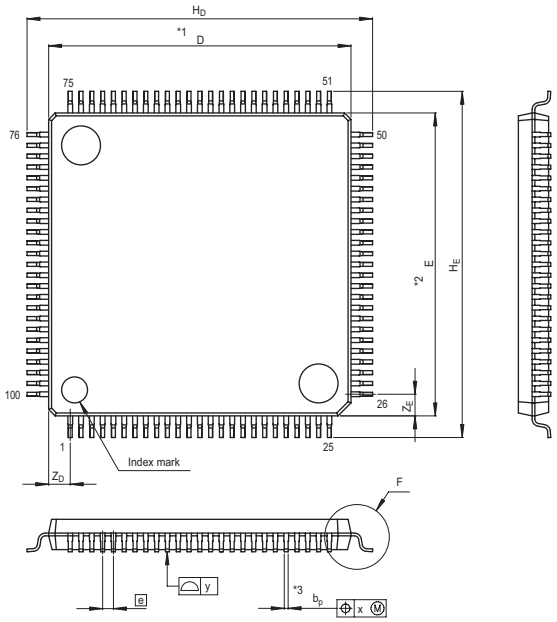
This IC has four different kinds of terminals, which are to be applied by constant voltage when used. (V_{CC}, V_{DD}, VrefU, VrefL)

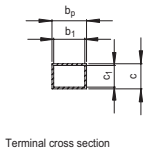
D/A converter precision may be worsened when ripple voltage or spike is duplicated on these four terminals.

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

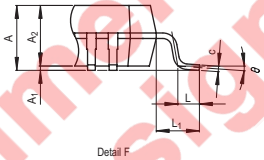
Package Dimensions

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-LQFP100-14x14-0.50	PLQP0100KB-A	100P6Q-A / FP-100U / FP-100UV	0.6g





Terminal cross section



Detail F

NOTE)
1. DIMENSIONS "*1" AND "*2" DO NOT INCLUDE MOLD FLASH.
2. DIMENSION "*3" DOES NOT INCLUDE TRIM OFFSET.

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	13.9	14.0	14.1
E	13.9	14.0	14.1
A_2	—	1.4	—
H_D	15.8	16.0	16.2
H_E	15.8	16.0	16.2
A	—	—	1.7
A_1	0.05	0.1	0.15
b_p	0.15	0.20	0.25
b_1	—	0.18	—
c	0.09	0.145	0.20
c_1	—	0.125	—
θ	0°	—	8°
e	—	0.5	—
x	—	—	0.08
y	—	—	0.08
Z_D	—	1.0	—
Z_E	—	1.0	—
L	0.35	0.5	0.65
L_1	—	1.0	—

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