

**M62334P/FP**  
**M62339P/FP**

**8-BIT 4CH I<sup>2</sup>C BUS D-A CONVERTER WITH BUFFER AMPLIFIERS**

**DESCRIPTION**

The M62334/M62339 is an integrated circuit semiconductor of CMOS structure with 4 channels of built in D-A converters with output buffer operational amplifiers.

The input is 2-wires serial method is used for the transfer format of digital data to allow connection with a microcomputer with minimum wiring.

The output buffer operational amplifier employs AB class output circuit with sync and source drive capacity of 1.0mA or more, and it operates in the whole voltage range from V<sub>cc</sub> to ground.

The M62333 and the M62338 differ only in their slave address.

**FEATURES**

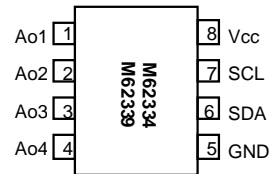
- Digital data transfer format  
I<sup>2</sup>C BUS serial data method
- Output buffer operational amplifier  
it operates in the whole voltage range from V<sub>cc</sub> to ground.
- High output current drive capacity  
±1.0mA over

**APPLICATION**

Conversion from digital data to analog control data for home-use and industrial equipment.

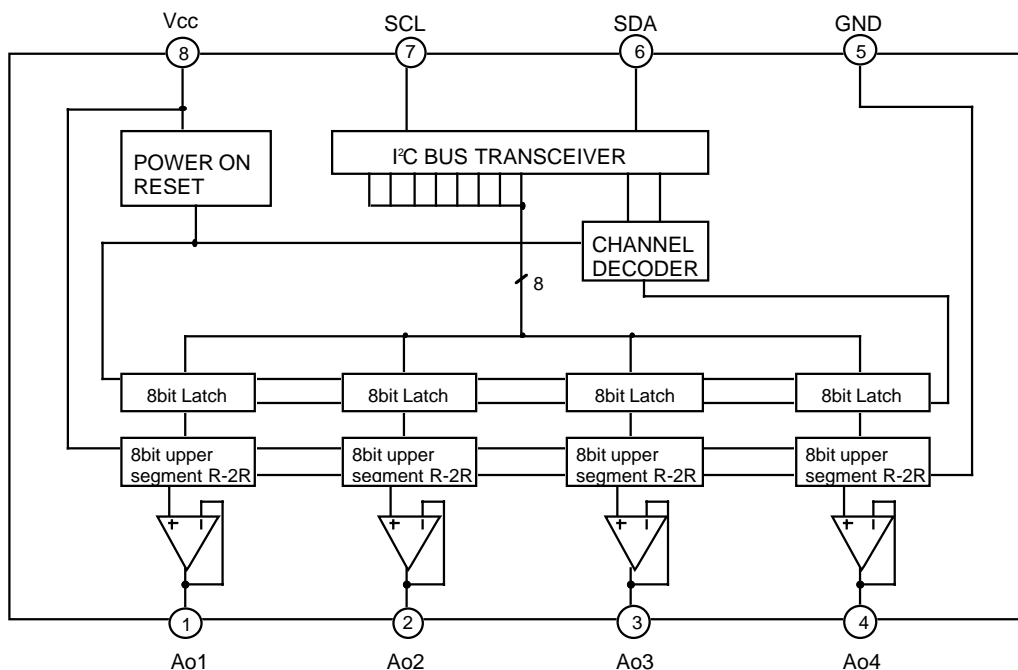
Signal gain control or automatic adjustment of DISPLAY-MONITOR or CTV.

**PIN CONFIGURATION(TOP VIEW)**



Outline 8P4 (P)  
8P2S-A (FP)

**BLOCK DIAGRAM**



**8-BIT 4CH I<sup>2</sup>C BUS D-A CONVERTER WITH BUFFER AMPLIFIERS****EXPLANATION OF TERMINALS**

Pin No.	Symbol	Function
⑥	SDA	Serial data input terminal
⑦	SCL	Serial clock input terminal
①	Ao1	8-bit resolution D-A converter output terminal
②	Ao2	
③	Ao3	
④	Ao4	
⑧	Vcc	Power supply terminal
⑤	GND	GND terminal

**ABSOLUTE MAXIMUM RATING**

Symbol	Parameter	Conditions	Ratings	Unit
Vcc	Supply voltage		-0.3 to 7.0	V
Vin	Input voltage		-0.3 to Vcc+0.3	V
Vo	Output voltage		-0.3 to Vcc+0.3	V
Pd	Power dissipation		417 (DIP) / 272 (FP)	mW
Topr	Operating temperature		-20 to 85	°C
Tstg	Storage temperature		-55 to 125	°C

**ELECTRICAL CHARACTERISTICS** (Vcc=+5V±10%, GND=0V, Ta=-20 to 85°C unless otherwise noted)

Symbol	Parameter	Test conditions	Ratings			Unit
			MIN	TYP	MAX	
Vcc	Supply voltage		2.7	5.0	5.5	V
Icc	Supply current	CLK=500kHz Operation, IAO=0μA Data : 6Ah (at maximum current)	0	1.4	3.0	mA
		SDA=SCL=GND, IAO=0μA	0	0.9	2.0	mA
IILK	Input leak current	VIN=0 to Vcc	-10		10	μA
VIL	Input low voltage		0		0.2Vcc	V
VIH	Input high voltage		0.8Vcc		Vcc	V
VAO	Buffer amplifier output voltage range	IAO=±100μA	0.1		Vcc-0.1	V
		IAO=±500μA	0.2		Vcc-0.2	V
IAO	Buffer amplifier output drive range	Upper side saturation voltage=0.3V Lower side saturation voltage=0.2V	-1.0		1.0	mA
SDL	Differential nonlinearity	VCC=5.12V(20mV/LSB) without load (IAO=0)	-1.0		1.0	LSB
SL	Nonlinearity		-1.5		1.5	LSB
SZERO	Zero code error		-2.0		2.0	LSB
SFULL	Full scale error		-2.0		2.0	LSB
Co	Output capacitive load				0.1	μF
Ro	Buffer amplifier output impedance			5.0		

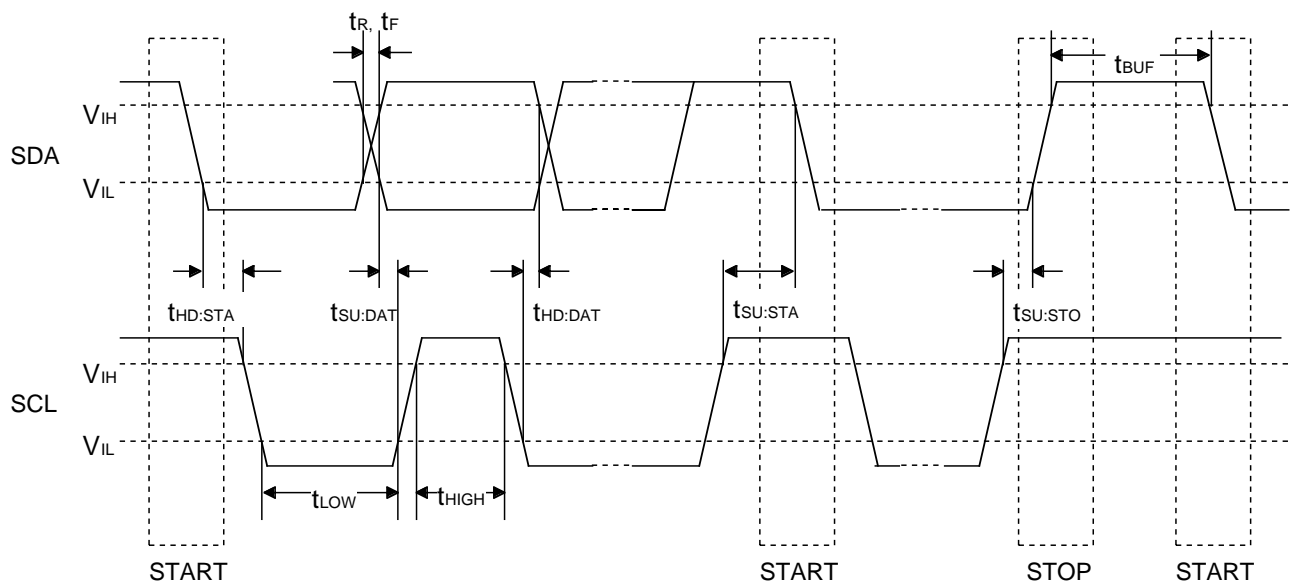
**8-BIT 4CH I<sup>2</sup>C BUS D-A CONVERTER WITH BUFFER AMPLIFIERS**

**I<sup>2</sup>C BUS LINE CHARACTERISTICS**

Symbol	Parameter	Min.	Max.	units
f <sub>SCL</sub>	SCL clock frequency	0	100	KHz
t <sub>BUF</sub>	Time the bus must be free before a new transmission can start	4.7	-	μs
t <sub>HD:STA</sub>	Hold time START Condition. After this period, the first clock pulse is generated.	4.0	-	μs
t <sub>LOW</sub>	LOW period of the clock	4.7	-	μs
t <sub>HIGH</sub>	HIGH period of the clock	4.0	-	μs
t <sub>SU:STA</sub>	Set-up time for START condition (Only relevant for a repeated START condition)	4.7	-	μs
t <sub>HD:DAT</sub>	Hold time DATA	0	-	μs
t <sub>SU:DAT</sub>	Set-up time DATA	250	-	ns
t <sub>R</sub>	Rise time of both SDA and SCL lines	-	1000	ns
t <sub>F</sub>	Fall time of both SDA and SCL lines	-	300	ns
t <sub>SU:STO</sub>	Set-up time for STOP condition	4.0	-	μs

- Note that a transmitter must internally provide at least a hold time to bridge the undefined region (max.300 ns) of the falling edge of SCL.

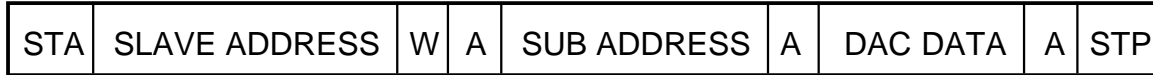
**TIMING CHART**



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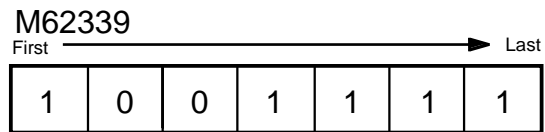
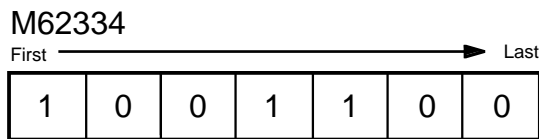
**I<sup>2</sup>C BUS FORMAT**



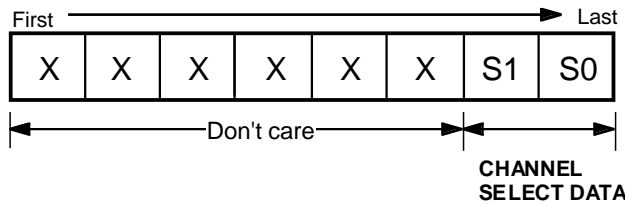
STA: start condition  
W: write(SDA=Low)

A: affirmation bit  
STP: stop condition

• **SLAVE ADDRESS**



• **SUB ADDRESS**



**CHANNEL SELECT DATA**

S1	S0	Channel selection
0	0	ch1 selection
0	1	ch2 selection
1	0	ch3 selection
1	1	ch4 selection

• **DAC DATA**



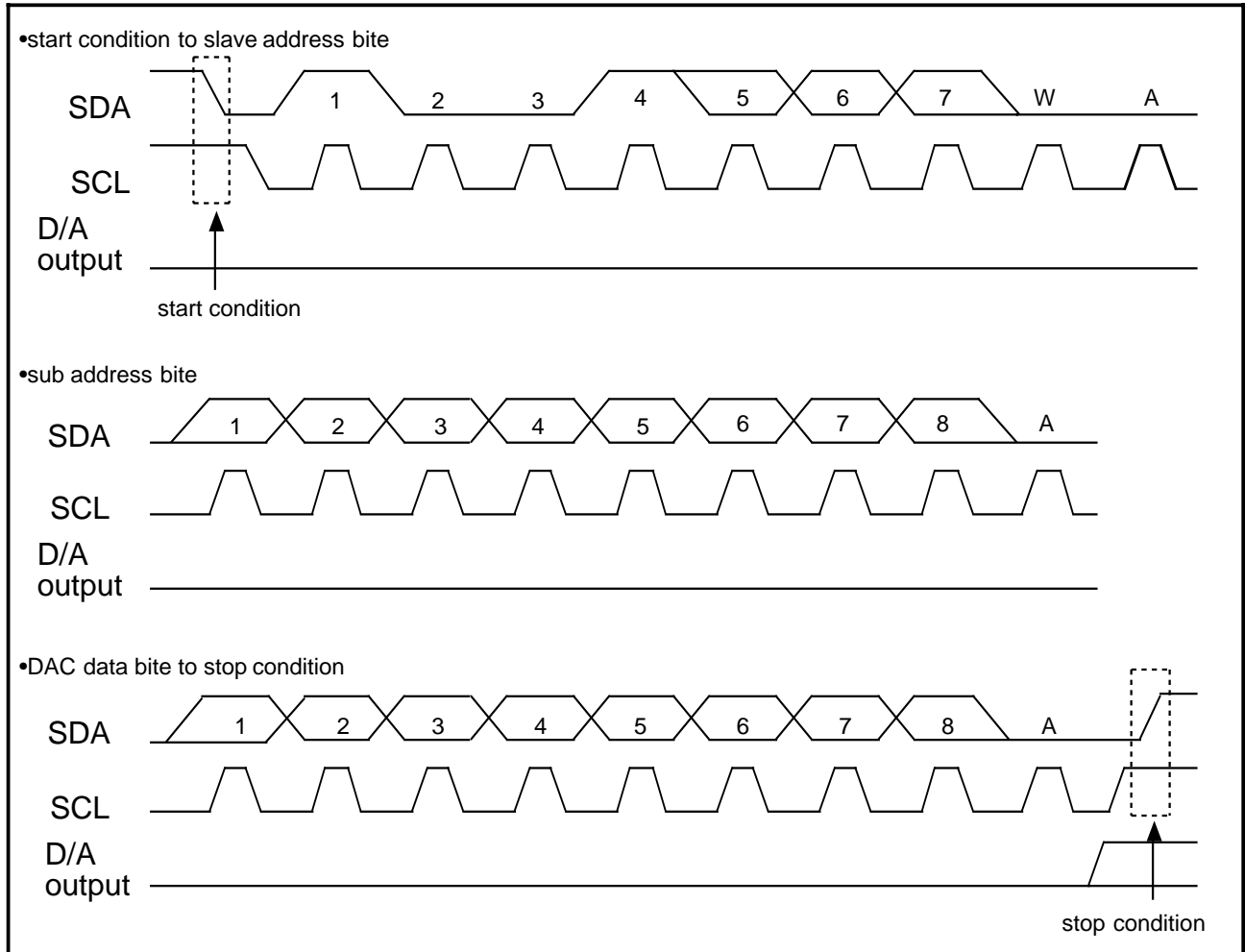
First MSB → Last LSB

D7	D6	D5	D4	D3	D2	D1	D0	DAC output
0	0	0	0	0	0	0	0	$V_{cc}/256 \times 1$
0	0	0	0	0	0	0	1	$V_{cc}/256 \times 2$
0	0	0	0	0	0	1	0	$V_{cc}/256 \times 3$
0	0	0	0	0	0	1	1	$V_{cc}/256 \times 4$
:	:	:	:	:	:	:	:	:
1	1	1	1	1	1	1	0	$V_{cc}/256 \times 255$
1	1	1	1	1	1	1	1	$V_{cc}$

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**TIMING CHART (MODEL)**



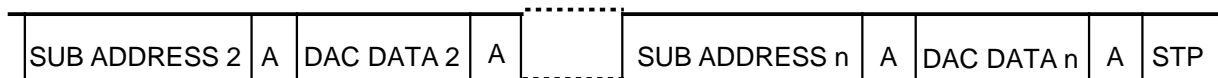
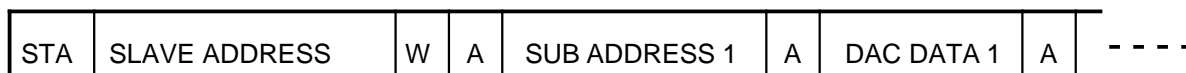
•Start condition With SCL at HIGH,SDA line goes from HIGH to LOW

•Stop condition With SCL at HIGH,SDA line goes from LOW to HIGH

(Under normal circumstances,SDA is changed when SCL is LOW)

•Acknowledge bit The receiving IC has to pull down SDA line whenever receive slave data.  
(The transmitting IC releases the SDA line just then transmit 8bit data.)

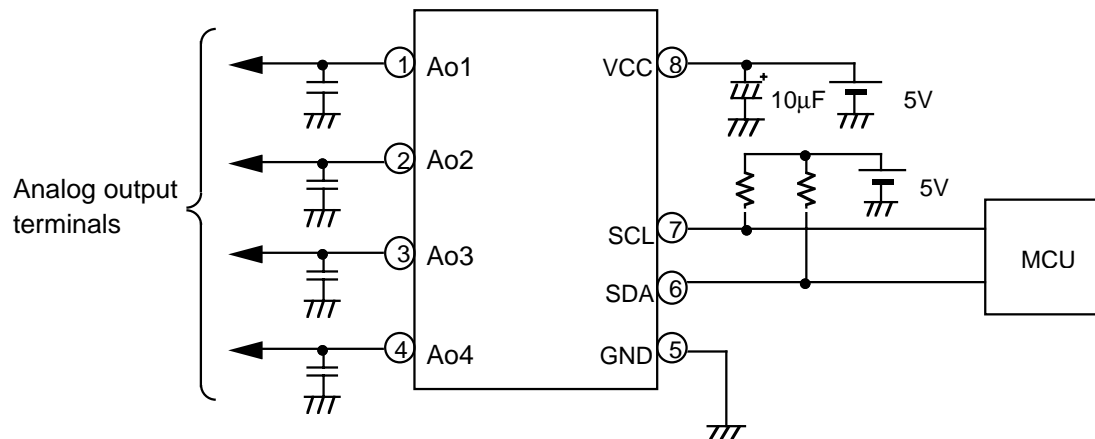
**Digital Data Formats**



**PRECAUTION FOR USE**

Supply voltage terminal(Vcc) is also used for D-A converter upper reference voltage setting. IF ripple or spike is input this terminal,accuracy of D-A conversion is down. So,when use this device,please connect capacitor among Vcc to GND for stable D-A conversion.

This IC's output amplifier has an advantage to capacitive load.So it's no problem at device action when connect capacitor (0.1 $\mu$  F MAX) among output to GND for every noise eliminate.

**APPLICATION EXAMPLE****Note regarding I<sup>2</sup>C BUS**

- Purchase of MITSUBISHI ELECTRIC CORPORATION'S I<sup>2</sup>C components conveys a license under the Philips I<sup>2</sup>C Patent Rights to use these components an I<sup>2</sup>C system,provided that the system conforms to I<sup>2</sup>C Standard Specification as defined by Philips.

**Keep safety first in your circuit designs!**

- Mitsubishi Electric Corporation puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury,fire or property damage. Remember to give due consideration to safety when making your circuit design, in order to prevent fires from spreading, redundancy, malfunction or other mishap.