

*ASSP Image Processing***30 MHz 8-bit A/D Converter  
(With AMP)****MB40C218****DESCRIPTION**

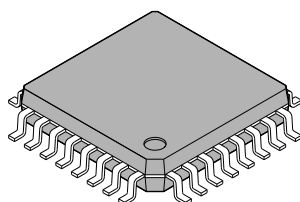
MB40C218 is a high-speed converter using a fast CMOS technology.

**FEATURES**

- Resolution : 8 bit
- Linearity error :  $\pm 0.2\%$  (standard)
- Differential linearity error :  $\pm 0.12\%$  (standard)
- Maximum conversion rate : 30 MSPS (minimum)
- Supply voltage : Amplifier  $+5.00 \pm 0.25$  [V]  
A/D converter  $+3.00 \pm 0.30$  [V]
- Digital input voltage range : TTL compatible
- Digital output voltage range : 3 V CMOS level compatible (tristate output)
- Analog input voltage range : 0 to 1.5 V (1.5 V<sub>P-P</sub>)
- analog input capacitance : 15 pF (standard)
- Power dissipation : 90 mW (standard: @ AV<sub>DD5</sub> = 5.00 V, AV<sub>DD3</sub> = DV<sub>DD</sub> = 3.00 V)
- Additional features : 1:3 gain amp with dual input selector (bandwidth: 20 MHz, inverting amp)  
VRT reference voltage adjustment amp  
Power saving capability  
Digital output test capability  
Analog input offset resistor
- Package : 32-pin plastic QFP

**PACKAGE**

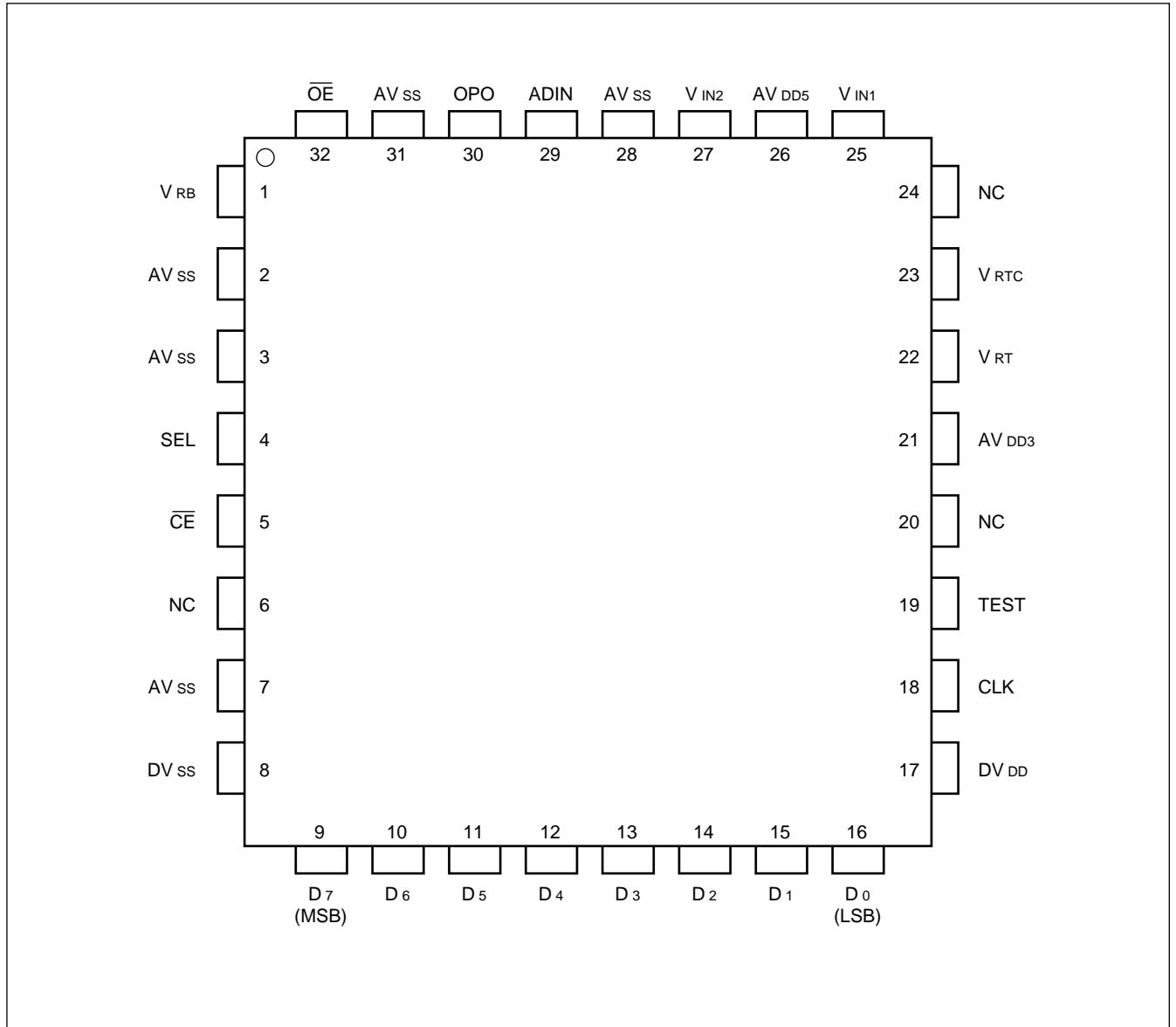
32 pin, Plastic QFP



(FPT-32P-M21)

# MB40C218

## ■ PIN ASSIGNMENT



## ■ DESCRIPTION OF PINS

Pin No.	Symbol	Description	
26	AV <sub>DD5</sub>	Analog section power supply (+ 5.00 V)	
21	AV <sub>DD3</sub>	A/D converter analog power supply (+ 3 V)	
17	DV <sub>DD</sub>	A/D converter digital power supply (+ 3 V)	
2, 3, 7, 28, 31	AV <sub>SS</sub>	Analog power supply ground pin (0 V)	
8	DV <sub>SS</sub>	Digital power supply ground pin (0 V)	
9 to 16	D <sub>7</sub> to D <sub>0</sub>	Digital output pin	
18	CLK	Clock input pin	
29	ADIN	A/D converter analog input pin. Input range is V <sub>RB</sub> to V <sub>RT</sub> (0 to 1.5 V) Relationship between analog input and digital output is defined by Test function.	
23	V <sub>RTC</sub>	Input pin for reference voltage adjustment amp (V <sub>RT</sub> reference voltage adjustment) V <sub>RT</sub> is adjusted so that it is 1.5 V with the input pin opened.	
22	V <sub>RT</sub>	Reference voltage output pin on top side. The voltage fed to V <sub>RTC</sub> is output.	
1	V <sub>RB</sub>	Reference voltage input pin on bottom side (0V)	
25	V <sub>IN1</sub>	Input pin 1 for 1:3 gain amp	Dual input selector for inverting amp
27	V <sub>IN2</sub>	Input pin 2 for 1:3 gain amp	
30	OPO	Input pin for 1:3 gain (at standby: high impedance)	
4	SEL	Toggle input pin for dual input selector for 1:3 gain amp Input "L": V <sub>IN1</sub> , Input "H": V <sub>IN2</sub>	Test function
5	$\overline{CE}$	Input pin for toggling standby function. Input high signal brings the standby state to the A/D converter, 1:3 gain amp, and reference voltage adjustment amp.	
32	$\overline{OE}$	Output (D <sub>7</sub> to D <sub>0</sub> ) enable input pin. Input low signal readies digital output. Input high signal induces high-impedance state.	
19	TEST	Test input pin.	
6, 20, 24	N.C.	No connection pins	

The values in parentheses are standard.

## ■ PRECAUTIONS ON USE

Be sure to ground the pins of AV<sub>DD5</sub>, AV<sub>DD3</sub>, DV<sub>DD</sub> and V<sub>RT</sub> via high-frequency capacitor.

Place the high-frequency capacitor as close as possible to the pin.

You can minimize the power supply current dissipation due to the internal logic indetermination by making  $\overline{CE}$  to high on power turning on.

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## ■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating		Units
		Min.	Max.	
Power supply voltage	AV <sub>DD5</sub> , AV <sub>DD3</sub> , DV <sub>DD</sub>	-0.3	+7.0	V
Input/output voltage	SEL, $\overline{CE}$ , $\overline{OE}$ CLK, TEST V <sub>RB</sub> , V <sub>RT</sub> , V <sub>RTC</sub> ADIN, V <sub>IN1</sub> , V <sub>IN2</sub> OPO	-0.3	AV <sub>DD5</sub> + 0.3	V
Digital output voltage	D <sub>0</sub> to D <sub>7</sub>	-0.3	DV <sub>DD</sub> + 0.3	V
Storage temperature	T <sub>stg</sub>	-55	+125	°C

Note: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. In the normal operations, it is recommended to use the device in the recommended conditions; exceeding the conditions may affect device reliability.

## ■ RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value			Units
		Min.	Typ.	Max.	
Power supply voltage	AV <sub>DD5</sub>	4.75	5.00	5.25	V
	AV <sub>DD3</sub>	2.70	3.00	3.30	V
	DV <sub>DD</sub>	2.70	3.00	3.30	V
Analog conversion range	V <sub>ADIN</sub>	V <sub>RB</sub>	—	V <sub>RT</sub>	V
Analog conversion voltage	V <sub>RT</sub> to V <sub>RB</sub>	1.05	—	2.10	V
Analog reference input voltage: T	V <sub>RTC</sub>	1.05	—	2.10	V
Analog reference voltage: B	V <sub>RB</sub>	0	—	—	V
Digital "H" level input voltage	V <sub>IHD</sub>	2.1	—	—	V
Digital "L" level input voltage	V <sub>ILD</sub>	—	—	0.8	V
Digital input current	I <sub>ID</sub>	—	—	5	μA
Clock frequency	f <sub>CLK</sub>	0.5	—	30	MHz
"H" level minimum clock pulse width	t <sub>w</sub> <sup>+</sup>	14.0	—	—	ns
"L" level minimum clock pulse width	t <sub>w</sub> <sup>-</sup>	14.0	—	—	ns
Operating temperature range	T <sub>a</sub>	-20	—	75	°C

## ■ ELECTRICAL CHARACTERISTICS

### 1. DC Characteristics

#### (1) Analog Section

( $AV_{DD5} = 4.75$  to  $5.25V$ ,  $AV_{DD3} = DV_{DD} = 2.70$  to  $3.30V$ ,  $T_a = -20$  to  $+75^{\circ}C$ )

Parameter		Symbol	Value			Units
			Min.	Typ.	Max.	
Resolution		—	—	8	—	bit
Linearity error	Conditional DC precision $V_{RT} = 1.5V$ $V_{RB} = 0V$	LE	—	$\pm 0.2$	$\pm 0.4$	%
Differential linearity error		DLE	—	$\pm 0.12$	$\pm 0.2$	%
Analog input capacity		$C_{ADIN}$	—	15	—	pF
Analog supply current		$AV_{DD5}$	—	7.0	—	mA
		$AV_{DD3}$	—	16.0	—	mA
Digital supply current		$DV_{DD}$	—	3.0	—	mA
Standby supply current		$I_{STB}$	—	100	—	$\mu A$
1:3 amp gain	DC to 10 MHz	$G_{amp}$	9.0	9.5	10.0	dB
	10 to 20 MHz		6.0	6.5	—	dB
$V_{IN1, 2}$ bias voltage		$V_{BI1, 2}$	—	$AV_{DD5}/2$	—	V
$V_{IN1, 2}$ input resistance		$R_{I1, 2}$	19	27	35	k $\Omega$
$V_{IN1, 2}$ input capacity		$C_{I1, 2}$	—	15	—	pF
1:3 gain amp group delay (DC to 10 MHz)		G-Delay	—	—	$\pm 10$	ns
1:3 gain amp ( $f_{in} = 4, 5, 7$ MHz)	2nd order harmonic distortion	H2	—	—	-50	dB
	3rd order harmonic distortion	H3	—	—	-55	dB
Dual power cross talk ( $f_{in} = 7$ MHz)		CT	—	—	-50	dB
Setup voltage with open $V_{RTC}$		$V_{RTC0}$	—	$AV_{DD3}/2$	—	V
$V_{RTC}$ input resistance		$V_{RTC}$	—	25	—	k $\Omega$
ADIN input resistance		$R_{ADIN}$	—	4.5	—	k $\Omega$

#### (2) Digital Section

( $AV_{DD5} = 4.75$  to  $5.25V$ ,  $AV_{DD3} = DV_{DD} = 2.70$  to  $3.30V$ ,  $T_a = -20$  to  $+75^{\circ}C$ )

Parameter		Symbol	Value			Units
			Min.	Typ.	Max.	
Digital "H" level output voltage		$V_{OHD}$	2.4	—	$DV_{DD}$	V
Digital "L" level output voltage		$V_{OLD}$	—	—	0.4	V
Digital "H" level output current		$I_{OHD}$	-400	—	—	$\mu A$
Digital "L" level output current		$I_{OLD}$	—	—	1.6	mA

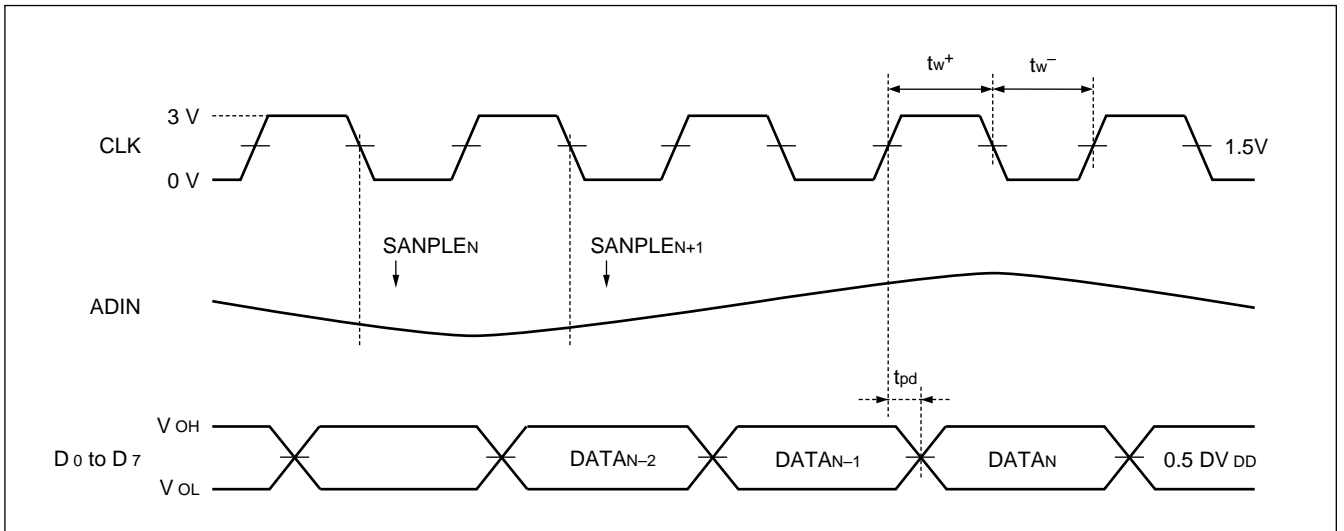
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## (3) Switching Section

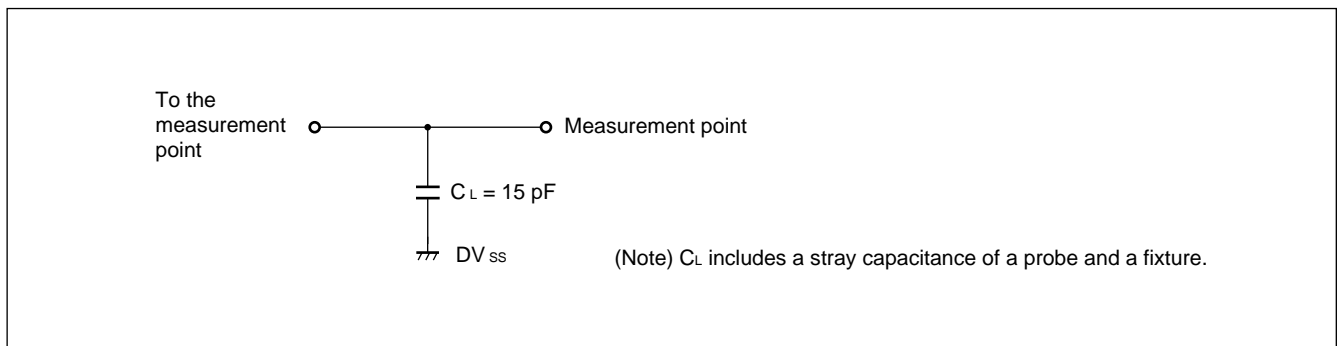
( $AV_{DD5} = 4.75$  to  $5.25V$ ,  $AV_{DD3} = DV_{DD} = 2.70$  to  $3.30V$ ,  $T_a = -20$  to  $+75^{\circ}C$ )

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Maximum conversion rate	$f_s$	30	—	—	MSPS
Digital output delay time	$t_{pd}$	7	13	25	ns

## ■ TIMING DIAGRAM



## ■ DIGITAL OUTPUT BUFFER LOAD CIRCUIT



■ TEST FUNCTION

TEST	$\overline{CE}$	SEL	$\overline{OE}$	D <sub>0</sub>	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	D <sub>5</sub>	D <sub>6</sub>	D <sub>7</sub>	
L	L	X	L	$\overline{D_0}$	$\overline{D_1}$	$\overline{D_2}$	$\overline{D_3}$	$\overline{D_4}$	$\overline{D_5}$	$\overline{D_6}$	$\overline{D_7}$	
L	H	X	L	L	L	L	L	L	L	L	L	
H	L	X	L	D <sub>0</sub>	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	D <sub>5</sub>	D <sub>6</sub>	D <sub>7</sub>	
H	H	L	L	H	L	H	L	H	L	H	L	
H	H	H	L	L	L	L	H	L	L	L	H	
X	X	X	H	← High impedance →								

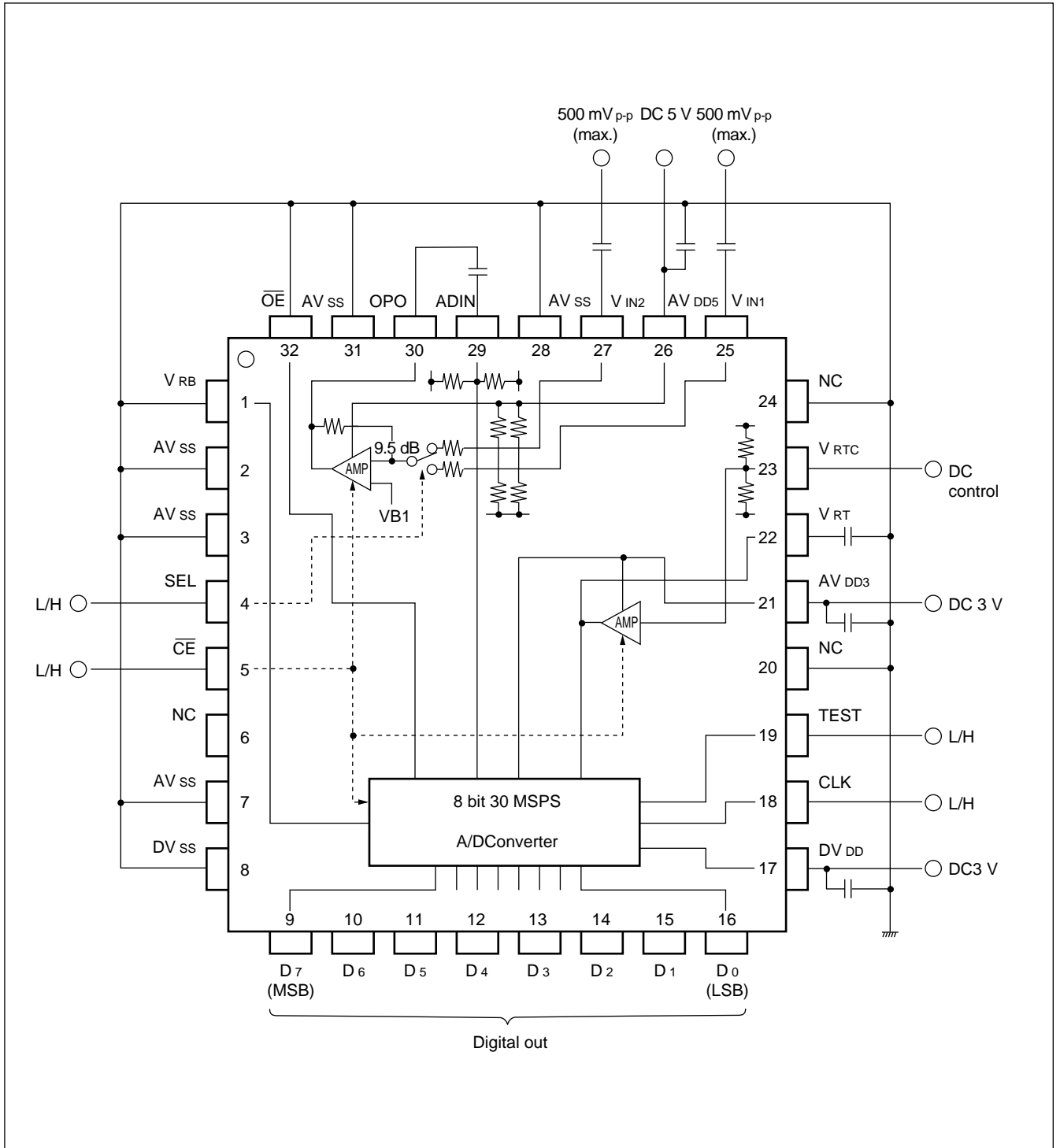
■ DIGITAL OUTPUT CODE

ADIN input voltage	Step	Digital output code	
		TEST = "L"	TEST = "H"
V <sub>RT</sub>	0	0000 0000	1111 1111
•	•	•	•
•	•	•	•
•	127	0111 1111	1000 0000
•	128	1000 0000	0111 1111
•	•	•	•
•	•	•	•
V <sub>RB</sub>	255	1111 1111	0000 0000

Condition:  $\overline{CE} = \overline{OE} = "L"$

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## ■ BLOCK DIAGRAM





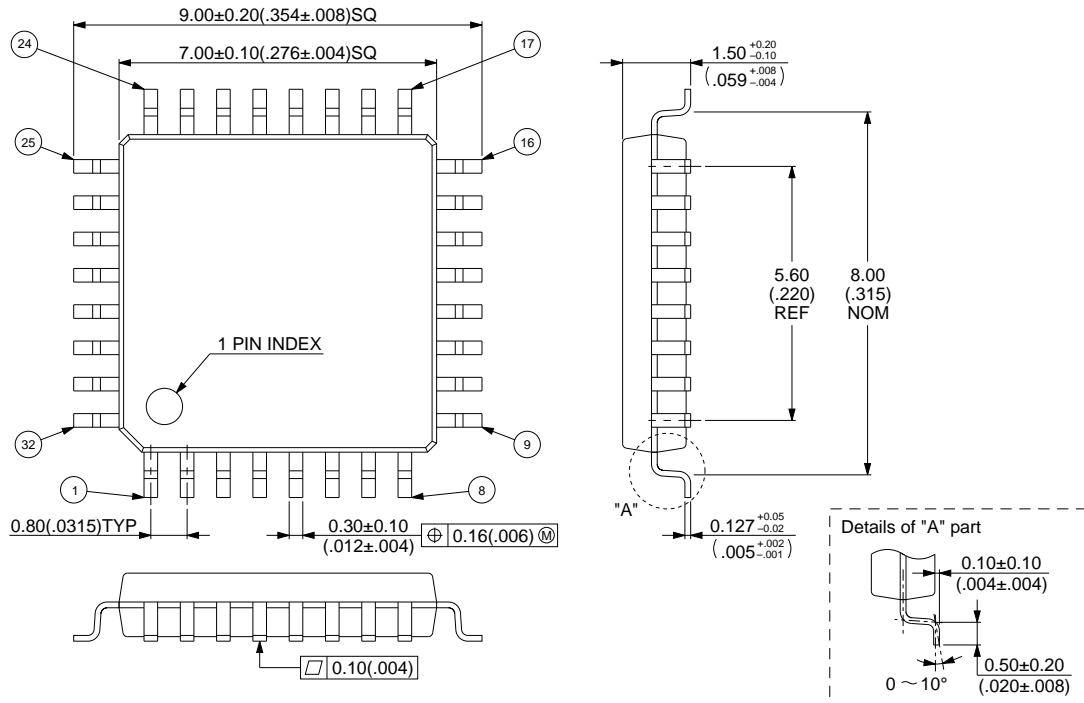
■ ORDERING INFORMATION

Part number	Package	Remark
MB40C218PFQ	32 pin, Plastic QFP (FPT-32P-M02)	

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## ■ PACKAGE DIMENSIONS

32 pin, Plastic QFP  
(FPT-32P-M21)



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Dimensions in mm (inch).

# MB40C218

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