

ASSP Image Processing

30 MHz 8-bit A/D Converter (With AMP)

MB40C218

■ DESCRIPTION

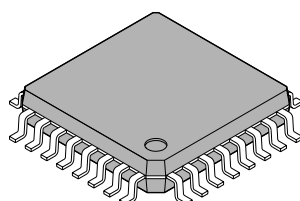
MB40C218 is a high-speed converter using a fast CMOS technology.

■ 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_{P-P})
- analog input capacitance : 15 pF (standard)
- Power dissipation : 90 mW (standard: @ AV_{DD5} = 5.00 V, AV_{DD3} = DV_{DD} = 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

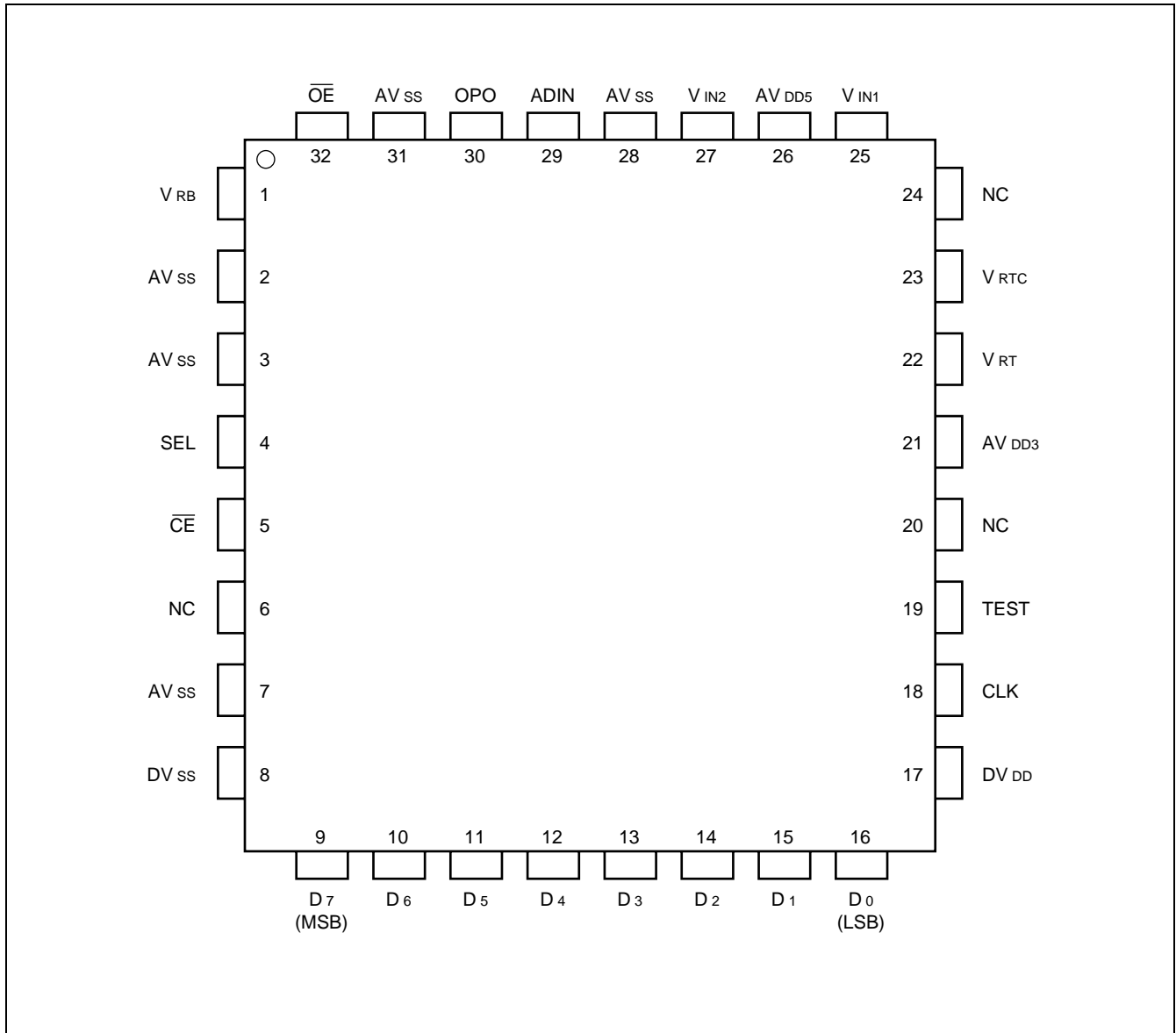
32 pin, Plastic QFP



(FPT-32P-M21)

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■ PIN ASSIGNMENT



■ DESCRIPTION OF PINS

Pin No.	Symbol	Description	
26	AV _{DD5}	Analog section power supply (+ 5.00 V)	
21	AV _{DD3}	A/D converter analog power supply (+ 3 V)	
17	DV _{DD}	A/D converter digital power supply (+ 3 V)	
2, 3, 7, 28, 31	AV _{SS}	Analog power supply ground pin (0 V)	
8	DV _{SS}	Digital power supply ground pin (0 V)	
9 to 16	D ₇ to D ₀	Digital output pin	
18	CLK	Clock input pin	
29	ADIN	A/D converter analog input pin. Input range is V _{RB} to V _{RT} (0 to 1.5 V) Relationship between analog input and digital output is defined by Test function.	
23	V _{RTC}	Input pin for reference voltage adjustment amp (V _{RT} reference voltage adjustment) V _{RT} is adjusted so that it is 1.5 V with the input pin opened.	
22	V _{RT}	Reference voltage output pin on top side. The voltage fed to V _{RTC} is output.	
1	V _{RB}	Reference voltage input pin on bottom side (0V)	
25	V _{IN1}	Input pin 1 for 1:3 gain amp	Dual input selector for inverting amp
27	V _{IN2}	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 _{IN1} , Input "H": V _{IN2}	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 ₇ to D ₀) 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_{DD5}, AV_{DD3}, DV_{DD} and V_{RT} 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 _{DD5} , AV _{DD3} , DV _{DD}	-0.3	+7.0	V
Input/output voltage	SEL, $\overline{\text{CE}}$, $\overline{\text{OE}}$ CLK, TEST V _{RB} , V _{RT} , V _{RTC} ADIN, V _{IN1} , V _{IN2} OPO	-0.3	AV _{DD5} + 0.3	V
Digital output voltage	D ₀ to D ₇	-0.3	DV _{DD} + 0.3	V
Storage temperature	T _{stg}	-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 _{DD5}	4.75	5.00	5.25	V
	AV _{DD3}	2.70	3.00	3.30	V
	DV _{DD}	2.70	3.00	3.30	V
Analog conversion range	V _{ADIN}	V _{RB}	—	V _{RT}	V
Analog conversion voltage	V _{RT} to V _{RB}	1.05	—	2.10	V
Analog reference input voltage: T	V _{RTC}	1.05	—	2.10	V
Analog reference voltage: B	V _{RB}	0	—	—	V
Digital "H" level input voltage	V _{IHD}	2.1	—	—	V
Digital "L" level input voltage	V _{ILD}	—	—	0.8	V
Digital input current	I _{ID}	—	—	5	μA
Clock frequency	f _{CLK}	0.5	—	30	MHz
"H" level minimum clock pulse width	t _w ⁺	14.0	—	—	ns
"L" level minimum clock pulse width	t _w ⁻	14.0	—	—	ns
Operating temperature range	T _a	-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	—	± 0.2	± 0.4	%
Differential linearity error		DLE	—	± 0.12	± 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	—	μA
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 Ω
$V_{IN1,2}$ input capacity		$C_{I1,2}$	—	15	—	pF
1:3 gain amp group delay (DC to 10 MHz)		G-Delay	—	—	± 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 Ω
ADIN input resistance		R_{ADIN}	—	4.5	—	k Ω

(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	—	—	μA
Digital "L" level output current		I_{OLD}	—	—	1.6	mA

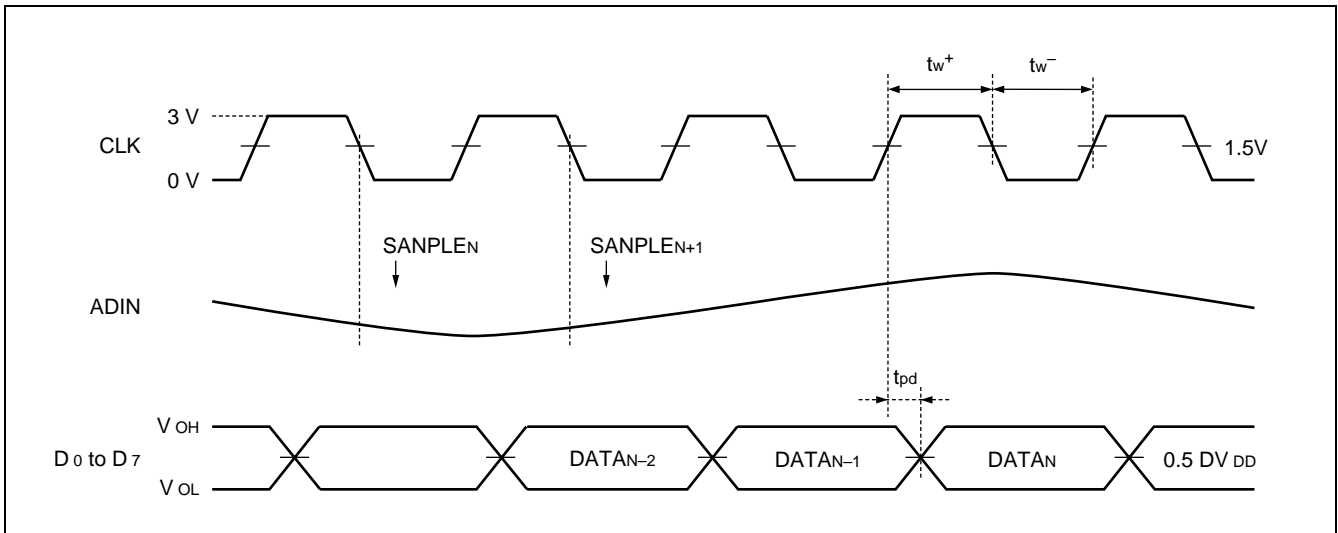
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(3) Switching Section

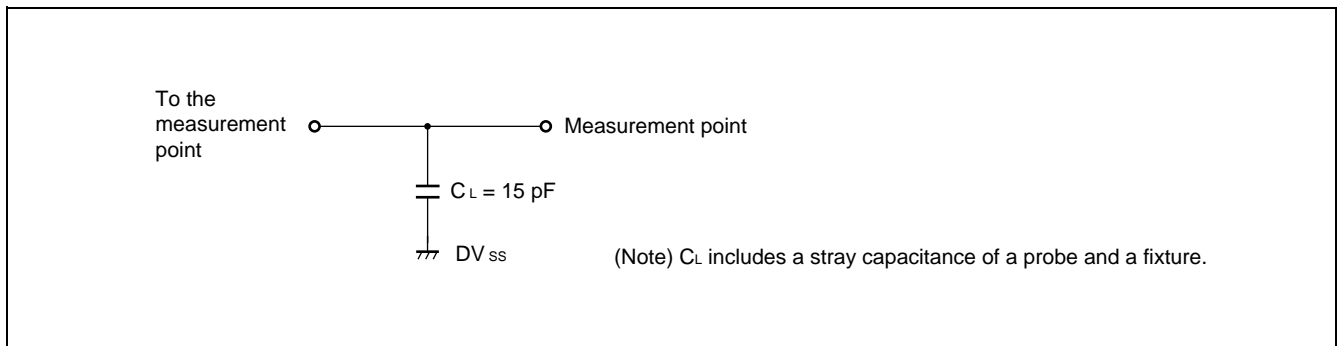
($AV_{DD5} = 4.75$ to $5.25V$, $AV_{DD3} = DV_{DD} = 2.70$ to $3.30V$, $T_a = -20$ to $+75^{\circ}C$)

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 ₀	D ₁	D ₂	D ₃	D ₄	D ₅	D ₆	D ₇
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 ₀	D ₁	D ₂	D ₃	D ₄	D ₅	D ₆	D ₇
H	H	L	L	H	L	H	L	H	L	H	L
H	H	H	L	L	H	L	H	L	H	L	H
X	X	X	H	← High impedance →							

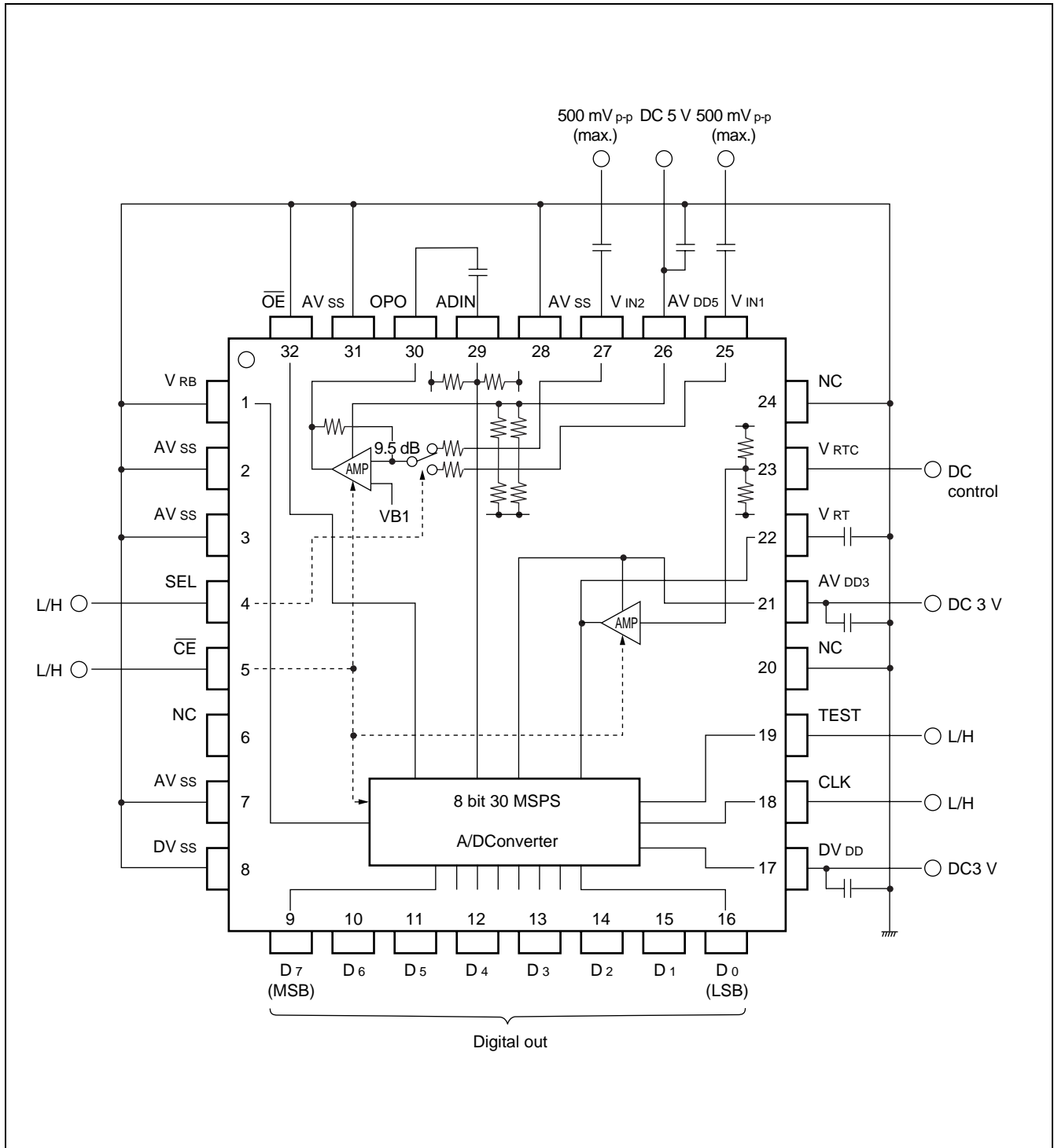
■ DIGITAL OUTPUT CODE

ADIN input voltage	Step	Digital output code	
		TEST = "L"	TEST = "H"
V _{RT}	0	0000 0000	1111 1111
•	•	•	•
•	•	•	•
•	127	0111 1111	1000 0000
•	128	1000 0000	0111 1111
•	•	•	•
•	•	•	•
V _{RB}	255	1111 1111	0000 0000

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

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■ BLOCK DIAGRAM



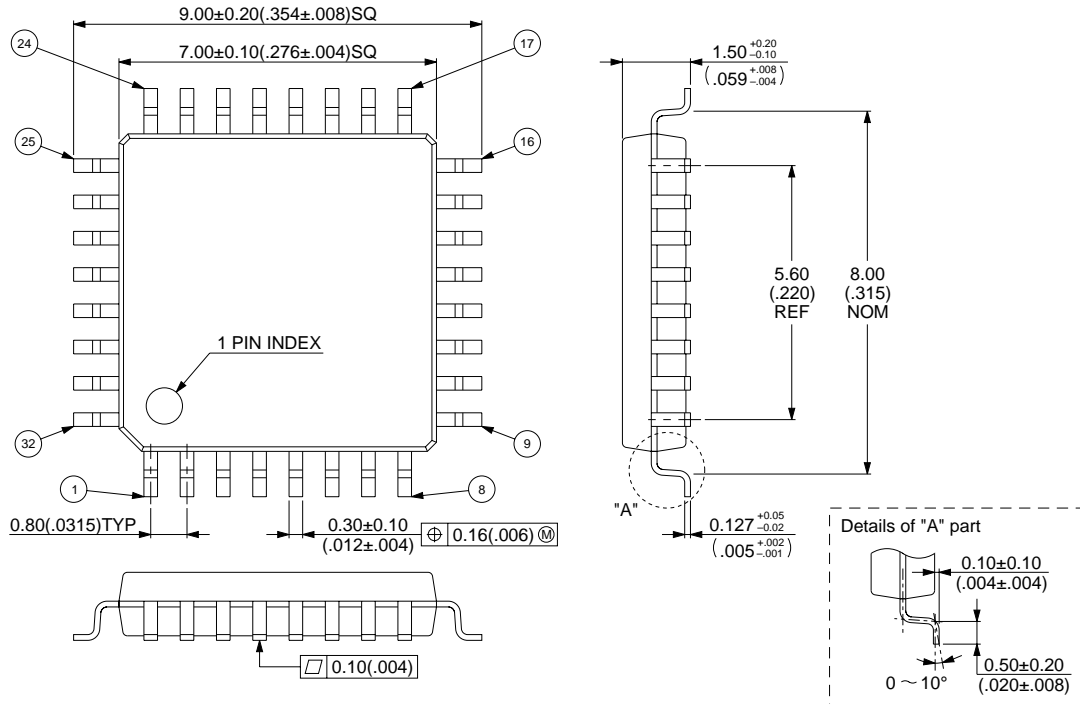
■ ORDERING INFORMATION

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).

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