FUJITSU SEMICONDUCTOR
DATA SHEET

ASSP

CMOS

20 MHz 10-bit A/D Converter

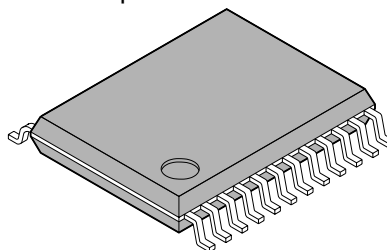# MB40C360

■ DESCRIPTION

MB40C360 is a high-speed A/D converter using a fast CMOS technology.

■ FEATURES

- Resolution : 10 bits
- Differential linearity error : ±1.0 LSB (max.)
- Maximum conversion rate : 20 MSPS (min.)
- Supply voltage : Single +3.0 V
- Digital in/output voltage : 3 V CMOS level (tristate)
- Analog input voltage range : 0 V to AV_{DD} (1.5 V to 2.1 Vp-p)
- Analog input capacitance : 18 pF (standard)
- Dissipation power : 40 mW
- Additional capabilities : Power saving function
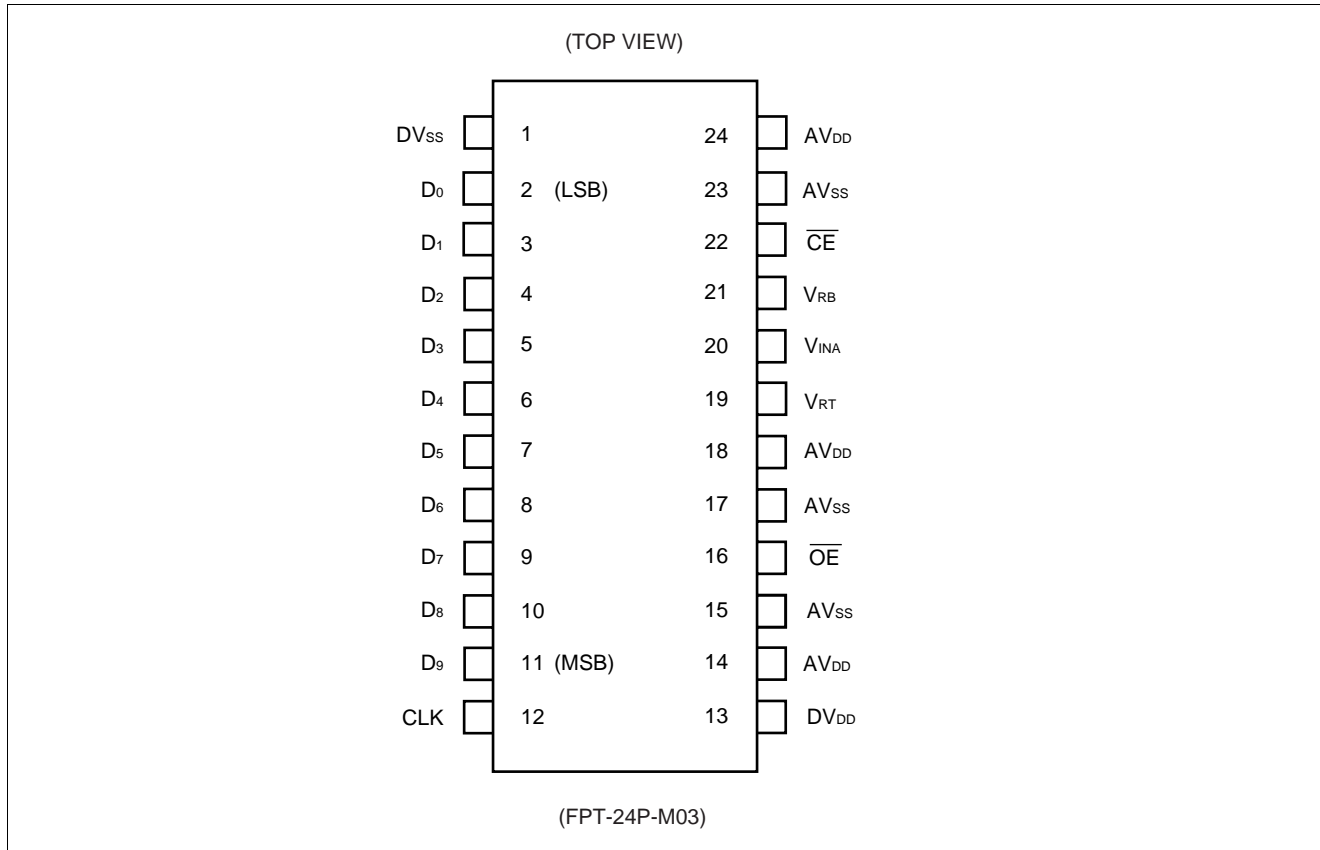 tristate output
- Package : 24-pin SSOP

■ PACKAGE

24-pin Plastic SSOP

(FPT-24P-M03)

MB40C360

■ PIN ASSIGNMENT

(TOP VIEW)

Left Pin	Pin No.		Pin No.	Right Pin
DV_{SS}	1		24	AV_{DD}
D_0	2 (LSB)		23	AV_{SS}
D_1	3		22	$\overline{CE}$
D_2	4		21	V_{RB}
D_3	5		20	V_{INA}
D_4	6		19	V_{RT}
D_5	7		18	AV_{DD}
D_6	8		17	AV_{SS}
D_7	9		16	$\overline{OE}$
D_8	10		15	AV_{SS}
D_9	11 (MSB)		14	AV_{DD}
CLK	12		13	DV_{DD}

(FPT-24P-M03)

■ PIN DESCRIPTION

Pin No.	Symbol	Description
14, 18, 24	AV_{DD}	Analog power supply (+3.0 V)
13	DV_{DD}	Digital power supply (+3.0 V)
15, 17, 23	AV_{SS}	Analog power supply ground pin (0 V)
1	DV_{SS}	Digital power supply ground pin (0 V)
2, 3, 4, 5, 6 7, 8, 9, 10, 11	D_0 to D_9	Digital output pin (D_0: LSB, D_9: MSB)
12	CLK	Clock input pin (3 V CMOS input)
20	V_{INA}	A/D converter analog input pin Input range is V_{RB} to V_{RT} (0 V to 2.0 V: standard)
19	V_{RT}	Reference voltage input pin on top side (2.0 V: standard)
21	V_{RB}	Reference voltage input pin on bottom side (0 V: standard)
22	$\overline{CE}$	Chip enable input pin Input high signal brings standby state. Input low signal brings operation state.
16	$\overline{OE}$	Output enable input pin Input high signal readies digital output high-impedance state. Input low signal induces digital output state.

Note: The values in parentheses are standard.

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■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating		Unit
		Min.	Max.	
Power supply voltage	AV_{DD}, DV_{DD}	−0.3	+4.0	V
Input voltage (analog/digital)	CLK, V_{INA}, V_{RT}, V_{RB}, $\overline{CE}$, $\overline{OE}$	−0.3	$AV_{DD} + 0.3$*	V
Output voltage	D_0 to D_9	−0.3	$DV_{DD} + 0.3$*	V
Storage temperature	Tstg	−55	+125	°C

* : Don't exceed 4.0V

WARNING: Semiconductor devices can be permanently damaged by application of stress (voltage, current, temperature, etc.) in excess of absolute maximum ratings. Do not exceed these ratings.

■ RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Power supply voltage	AV_{DD}	2.70	3.00	3.60	V
	DV_{DD}	2.70	3.00	3.60	V
	| $AV_{DD} - DV_{DD}$ |	0.0	—	0.2	V
Analog input voltage	V_{INA}	V_{RB}	—	V_{RT}	V
Analog reference voltage: T	V_{RT}	1.5	2.0	AV_{DD}	V
Analog reference voltage: B	V_{RB}	0.0	—	$AV_{DD} - 1.5$	V
Analog reference voltage range	$V_{RT} - V_{RB}$	1.5	2.0	2.1	V
Digital "H" level input voltage	V_{IHD}	2.3	—	DV_{DD}	V
Digital "L" level input voltage	V_{ILD}	0	—	0.5	V
Digital input current	I_{ID}	—	—	5	μA
Clock frequency	f_{CLK}	0.5	—	20	MHz
"H" level minimum clock pulse width	$t_W{}^+$	20.0	—	—	ns
"L" level minimum clock pulse width	$t_W{}^-$	20.0	—	—	ns
Operating temperature range	Ta	−20	—	+70	°C

WARNING: The recommended operating conditions are required in order to ensure the normal operation of the semiconductor device. All of the device's electrical characteristics are warranted when the device is operated within these ranges.

Always use semiconductor devices within their recommended operating condition ranges. Operation outside these ranges may adversely affect reliability and could result in device failure.

No warranty is made with respect to uses, operating conditions, or combinations not represented on the data sheet. Users considering application outside the listed conditions are advised to contact their FUJITSU representatives beforehand.

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■ ELECTRICAL CHARACTERISTICS

• Analog Section

(AV$_{DD}$ = 2.7 V to 3.6 V, DV$_{DD}$ = 2.7 V to 3.6 V, V$_{RT}$ = 2.0 V, V$_{RB}$ = 0 V, Ta = −20°C to +70°C)

Parameter		Symbol	Value			Unit
			Min.	Typ.	Max.	
Resolution		RES	—	10	—	bit
Linearity error	DC precision	LE	—	±1.00	±2.00	LSB
Differential linearity error		DLE	—	±0.50	±1.00	LSB
Analog input capacity		C$_{INA}$	—	18	—	pF
Analog "H" level input current		I$_{IHA}$*1	—	200	—	μA
Analog "L" level input current		I$_{ILA}$*2	—	−250	—	μA
Analog input bandwidth (−0.5 dB)		f$_{BW}$	—	20	—	MHz
Reference current (BOTTOM side)		I$_{RB}$	3.0	6.0	10.0	mA
Analog supply current		AI$_{DD}$	—	13.0	40.0	mA
Digital supply current		DI$_{DD}$	—	1.5	4.0	mA
Standby supply current		I$_{STBA}$	—	100	—	μA
		I$_{STBD}$	—	5	—	μA

*1: V$_{INA}$ = 2.0 V
*2: V$_{INA}$ = 0.0 V

• Digital Section

(AV$_{DD}$ = 2.7 V to 3.6 V, DV$_{DD}$ = 2.7 V to 3.6 V, V$_{RT}$ = 2.0 V, V$_{RB}$ = 0 V, Ta = −20°C to +70°C)

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Digital "H" level output voltage	V$_{OHD}$	2.5	—	DV$_{DD}$	V
Digital "L" level output voltage	V$_{OLD}$	0	—	0.4	V
Digital "H" level output current	I$_{OHD}$	−400	—	—	μA
Digital "L" level output current	I$_{OLD}$	—	—	1.6	mA

• Switching Section

(AV$_{DD}$ = 2.7 V to 3.6 V, DV$_{DD}$ = 2.7 V to 3.6 V, V$_{RT}$ = 2.0 V, V$_{RB}$ = 0 V, Ta = −20°C to +70°C)

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Maximum conversion rate	f$_S$	20	—	—	MSPS
Digital output delay time	t$_{pd}$	1	6	15	ns

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■ DIAGRAM
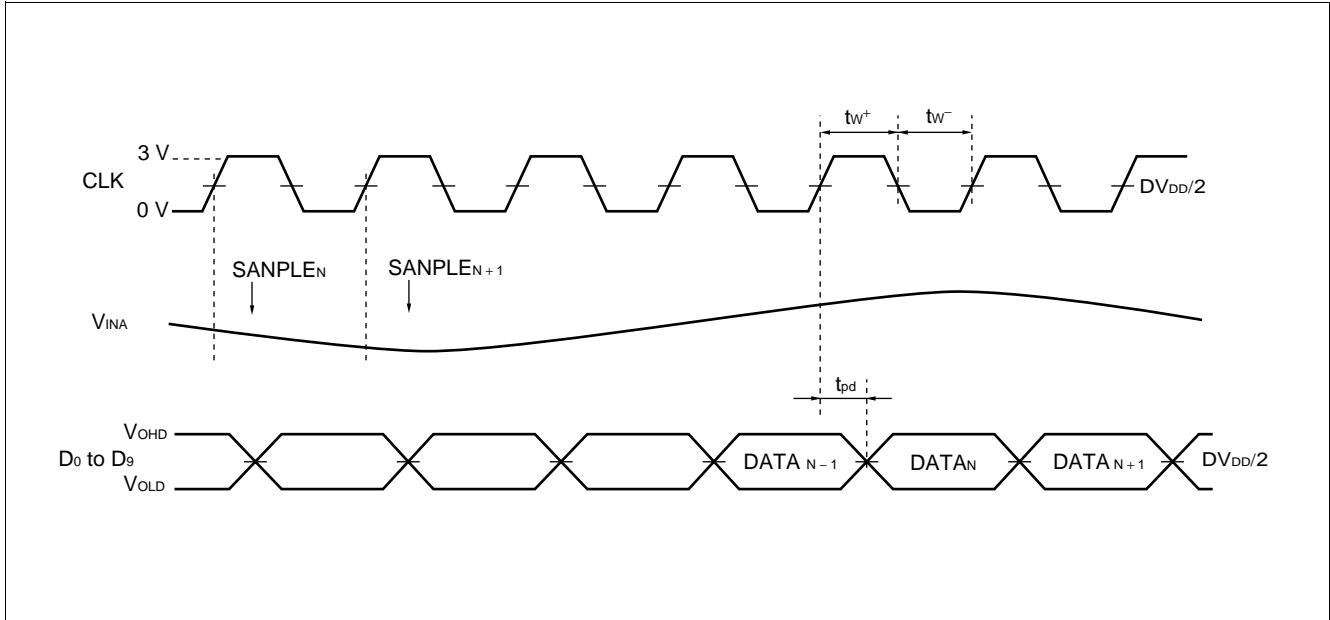
■ DIGITAL OUTPUT BUFFER LOAD CIRCUIT

(Note) C_L includes a stray capacitance of a probe and a fixture.
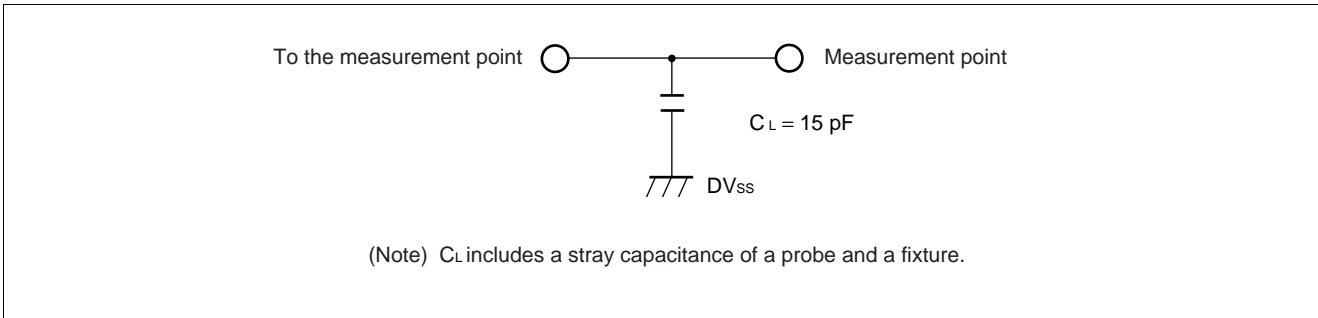
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■ **USAGE PRECAUTIONS**

• Be sure to ground the pins of AV_{DD}, DV_{DD}, V_{RT} and V_{RB} via high-frequency capacitor. Place the high-frequency capacitor as close as possible to the pin.
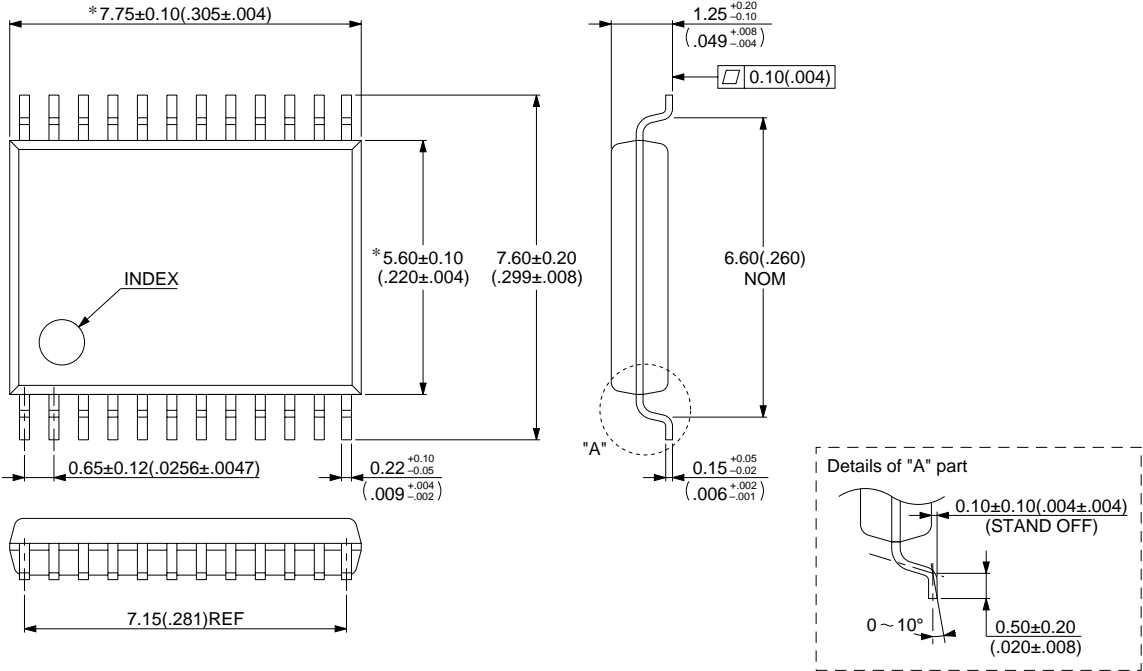• You can minimize the power supply current dissipation due to the internal logic indetermination by making the clock to 4CLK or higher.

■ **ORDERING INFORMATION**

Part number	Package	Remark
MB40C360PFV	24-pin Plastic SSOP (FPT-24P-M03)	

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■ PACKAGE DIMENSION

24-pin Plastic SSOP
(FPT-24P-M03)

＊7.75±0.10(.305±.004)

＊5.60±0.10
(.220±.004)

7.60±0.20
(.299±.008)

INDEX

0.65±0.12(.0256±.0047)

$0.22^{+0.10}_{-0.05}$
$\left(.009^{+.004}_{-.002}\right)$

7.15(.281)REF

$1.25^{+0.20}_{-0.10}$
$\left(.049^{+.008}_{-.004}\right)$

☐ 0.10(.004)

6.60(.260)
NOM

"A"

$0.15^{+0.05}_{-0.02}$
$\left(.006^{+.002}_{-.001}\right)$

Details of "A" part

0.10±0.10(.004±.004)
(STAND OFF)

0 ～ 10°

0.50±0.20
(.020±.008)

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Dimensions in mm (inches).

MB40C360

FUJITSU LIMITED

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